OVEMBER 11, 1943

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We must not make another mistake and be unprepared for peace. What we do after this war to help a stricken world will be as important as our leadership and industry during this war.

If private industry anticipates the vast postwar demands which will fall upon American industry, and plans for it now, there will be work and jobs for millions of returned soldiers and ex-war workers.

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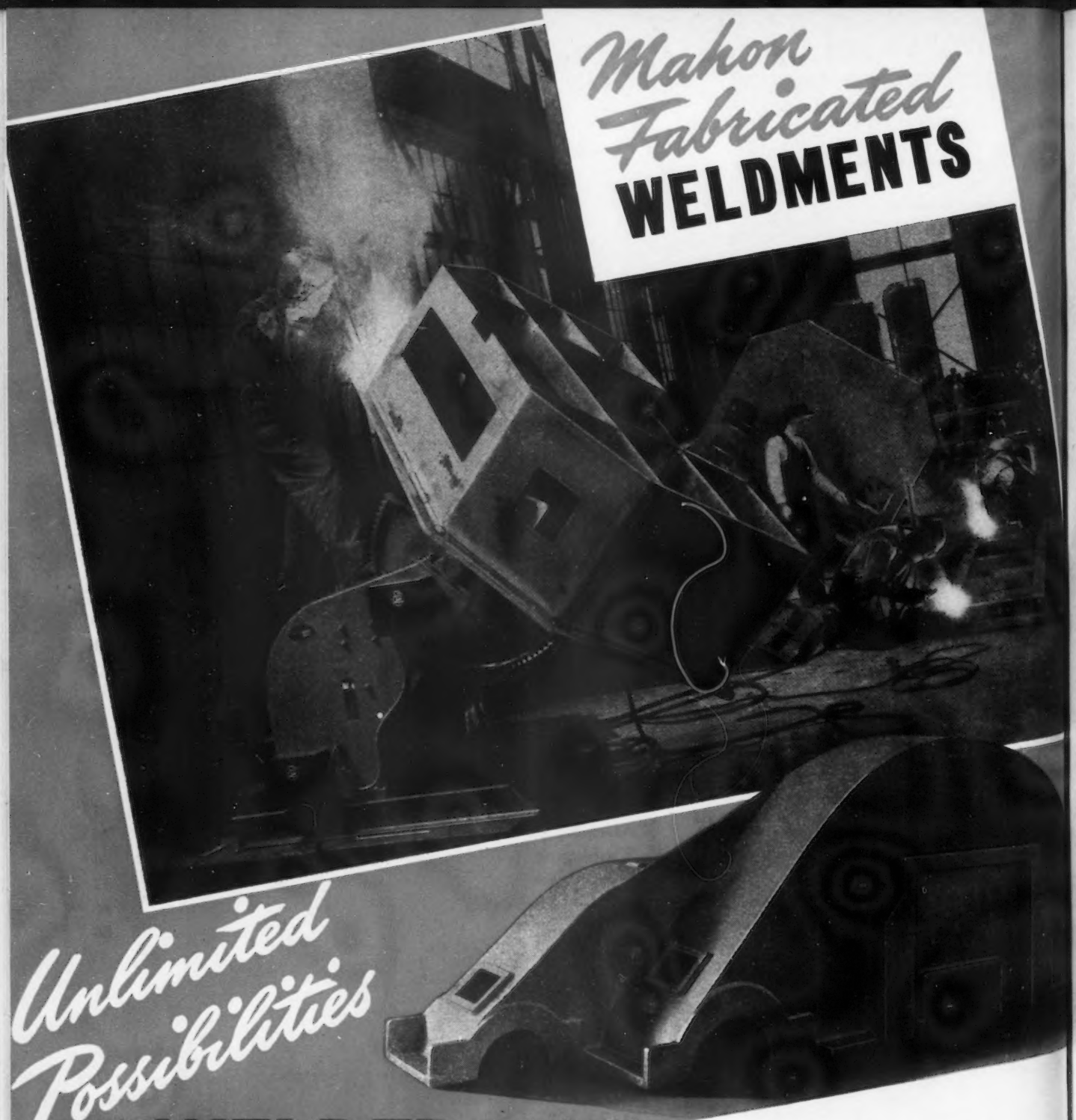

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Pearl Harbor—Plus

FOUR walkouts have occurred in seven months in the most essential industry of a country that is throwing its all into the world conflict. If that does not mean that something is radically wrong on the home front, I do not know what would.

What is the use of sending eminent emissaries abroad to Moscow to draw the plans for future world management when it becomes more obvious, day by day, that we are unable, even by Presidential order under war emergency powers to control an industry with a mere half million workers? Or to depict the fragrance of world relationships to come when we have a stench in our own backyard that reaches high heaven!

Well, by this time, those Americans who are not completely gullible should have learned that plans and promises from politicians' portfolios are not related in any way to performance. And that all of the exhortations to united action in defense of our democracy do not prevent one citizen from stabbing his fellow citizens in the back when self interest so dictates. And neither does government.

That's the pity of it, *neither does government.*

In a family with unruly children who will not obey, the fault lies with the parents. Likewise, in this disastrous controversy between the operators, miners and War Labor Board, the blame sits squarely upon the doorstep of the Administration. No one can say that it has not had time to act, for this is the fourth walkout in seven months in the coal industry and all of them in time of war. Any general of the armed forces who had four mutinies on his hands in seven months and who was impotent in putting a stop to them would be recalled, demoted and disgraced. And any general who permitted men under his command to seize guns and ammunition and attack their own fighting comrades would, or should face court martial and a possible firing squad.

Strikes in our coal industry have put more ships out of action by denying the steel with which to build them than two Pearl Harbors. The first stoppage cost us 50 Liberty ships in steel tonnage; tonnage that could not possibly be replaced because of capacity operation of our mills.

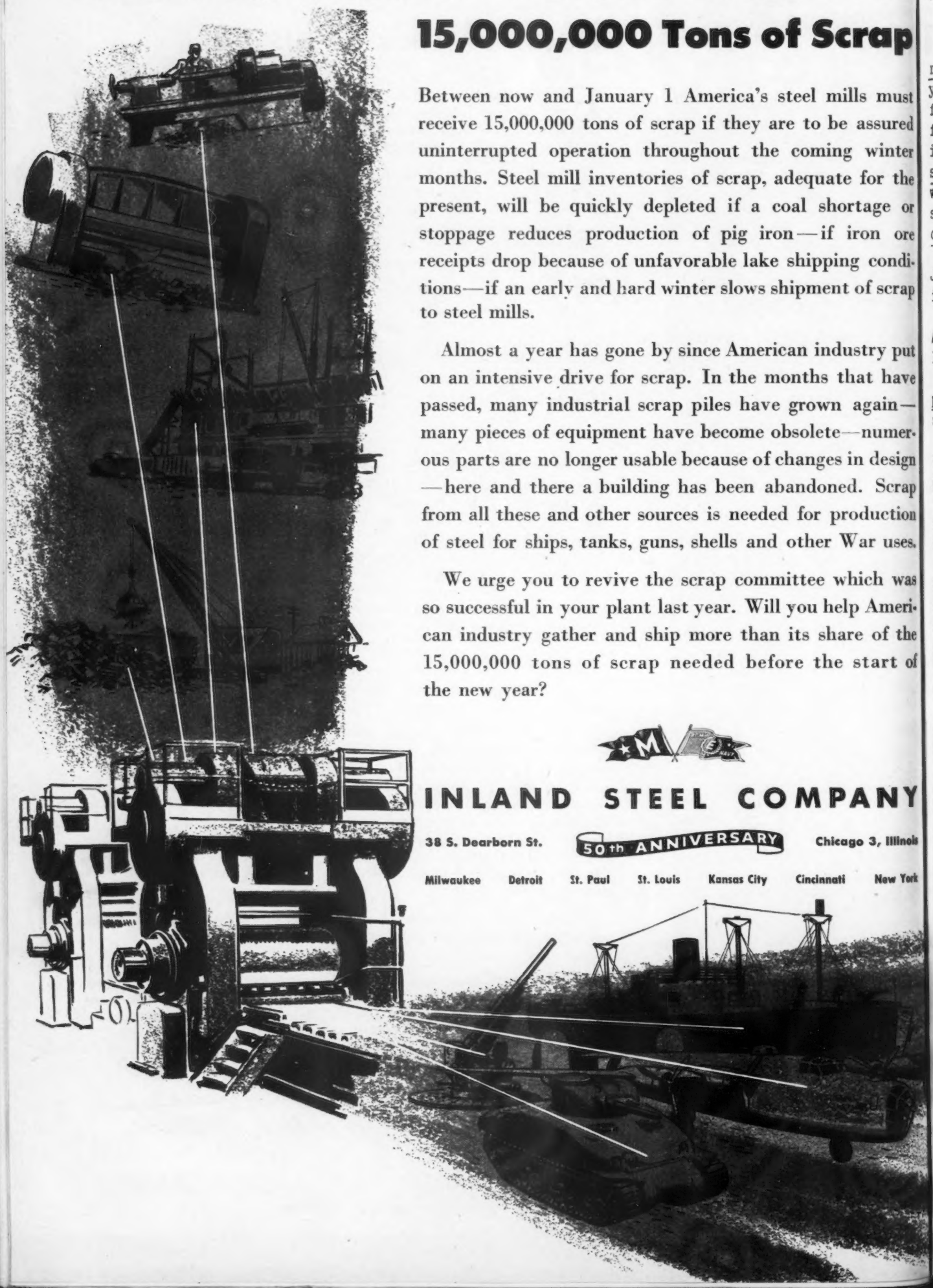
The President has put the mines in the hands of Mr. Ickes and has ordered the men back to work. It is important that they go back to producing the coal that we need so badly, but it is more important, much more so, that they do not go back under a face-saving agreement that is a sell-out and surrender by government. The proposed agreement, latest as this is written, giving the miners all they demand in exchange for a 15 min. lunch period may be Mr. Ickes' idea of the easiest way out but it is like a general claiming victory when he exchanges his sword for the enemy's coat button. Whistles for lunch periods do not blow underground.

God help us if the cost of putting the miners back to work is our loss of confidence in our government's ability to preserve order without appeasement.

If you really want to know who has won this battle on the domestic front, forget the newspaper headlines emanating from Washington and watch the steel production rate. That will tell you who is boss.

URGENTLY NEEDED BEFORE JAN. 1...

15,000,000 Tons of Scrap



Between now and January 1 America's steel mills must receive 15,000,000 tons of scrap if they are to be assured uninterrupted operation throughout the coming winter months. Steel mill inventories of scrap, adequate for the present, will be quickly depleted if a coal shortage or stoppage reduces production of pig iron—if iron ore receipts drop because of unfavorable lake shipping conditions—if an early and hard winter slows shipment of scrap to steel mills.

Almost a year has gone by since American industry put on an intensive drive for scrap. In the months that have passed, many industrial scrap piles have grown again—many pieces of equipment have become obsolete—numerous parts are no longer usable because of changes in design—here and there a building has been abandoned. Scrap from all these and other sources is needed for production of steel for ships, tanks, guns, shells and other War uses.

We urge you to revive the scrap committee which was so successful in your plant last year. Will you help American industry gather and ship more than its share of the 15,000,000 tons of scrap needed before the start of the new year?

INLAND STEEL COMPANY

38 S. Dearborn St. — 50th ANNIVERSARY — Chicago 3, Illinois

Milwaukee Detroit St. Paul St. Louis Kansas City Cincinnati New York

The IRON AGE
NOV. 11, 1943

NEWS FRONT

• H. G. Batcheller has been asked by Allegheny-Ludlum Steel Corp. directors to return to active management of the company, a move made particularly pressing by the yet unannounced retirement some weeks ago of W. F. Detwiler, Chairman of the Board, from active participation in company affairs. Mr. Batcheller's eminent performance, first as Director of WPB's Steel Division, then as vice-chairman in charge of all industry operations of WPB, is said to make Mr. Nelson reluctant to relinquish his services by such early date as Dec. 1. In view of Mr. Batcheller's conviction that winning the war is of paramount importance, he is averse to arbitrarily resign if such action would in even a small way jeopardize the production effort. Disposition of the matter still rests with Mr. Nelson.

• Chromium, tungsten, molybdenum, and vanadium will all likely go off allocation by Jan. 1. Existing rules forcing a percentage use of alloy scrap will, however, remain in force.

• NE steels now account for 30 per cent of total monthly alloy steel consumption. Additional substitution for higher alloyed steels is now rising only very slowly and likely will never reach 43 per cent, which is considered the top limit.

• The bulk of Kaiser's Fontana export ingots are leaving the country via Gulf ports. The $43 base plus the long freight haul presents Lend-Lease with a pretty stiff bill to pay.

• Meanwhile: Kaiser is asking OPA to lift his ingot base to over $45. With close to a .350 batting average on requests of this kind, it is likely the petition will be granted.

• Current alloying element consumption, in pounds per net ton of total alloy steel ingots produced, is 10.6 for nickel, 19.5 for chromium, 20 for molybdenum, 0.302 for tungsten, and 0.10 for vanadium.

• Of the two all-stainless freight airplanes designed and fabricated by E. G. Budd Mfg. Co., one has passed all static tests and the other was flight-tested a week ago, with performance exceeding all expectations. Six additional ships are about ready to roll off the line, and the company is now swinging into full production on its 1000-plane order.

• These freight planes will undoubtedly influence a far greater acceptance of stainless as an aircraft construction material.

• Tubular railway axles, 500 a day, are now being turned out by Pittsburgh Steel Co. The tubular unit weighs 25 to 43 per cent less than the conventional solid axle, and preliminary tests indicate far greater strength and fatigue resistance.

• In recent raids the U. S. Eighth air force abandoned its former policy of precision bombing in favor of mass sorties similar to the British night "area" attacks. Growing number of U. S. bombers does not make it strategically advisable to wait for the occasional winter weather conditions suitable for precision bombing.

• The German radio recently announced shooting down five Allied aircraft of a new type, called "hedgehoppers," and designed for low-level strafing. This is the first indication that the Allies may have in production a specialized ground-strafer for attacks on infantry.

• An extraordinary airplane has been developed by the Allies, and already is in limited use on anti-submarine patrol. It has the get-off and landing properties of a helicopter, within a foot or two, but is far faster and more maneuverable than the helicopter.

• Used ball and roller bearings and component parts are now funnelled from all British industry into the Bearing Control, Ministry of Supply. They are cleaned, graded and re-conditioned for re-use; excessively worn balls and rollers are used for ball-mill purposes (paint, grinding, etc.)

• Despite a current flood of rumors that recently captured German tanks have carried greatly inferior armor, the Ordnance Department has not yet found the slightest deterioration in the excellent construction or metallurgy of German materiél.

• New scrap depots are being set up at Frederick, Md. (for the ports of Norfolk and Baltimore), at Seattle and at San Francisco. The New York and Boston depots, in operation for sometime, could easily handle the 12,000 tons entering in September, but recent very heavy shipments require additional facilities.

. . . Current Zinc Electroplating P

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By ADOLPH BREGMAN
Consulting Engineer, New York

o o o

In this, the first of a two-part article, the author discusses the commercially important methods of electrogalvanizing and evaluates their relative merits and disadvantages.

FOR more than a century zinc coatings have served as the most satisfactory commercial method of protecting ferrous products against corrosion. This is rather remarkable considering the vast amount of scientific and technical knowledge that has been amassed during this period. The explanation is first the position of zinc in the electromotive series of the metals, and second, the relative abundance and low cost of zinc in normal times.

The primary function of a zinc coating is to provide resistance to corrosion, rather than any decorative purposes, or protection against mechanical wear. The factors that determine the durability of the zinc coating are its uniformity, its thickness and the nature of the atmosphere to which it is exposed.

The production of zinc coatings by electrodeposition offers a number of advantages over the other methods of coating (hot dipping, sherardizing, and spraying). Particularly on relatively simple shapes and forms, on which good current distribution can be obtained, uniform coatings of predetermined thickness are obtained by controlling the amount of current and the time of deposition, and threaded parts can be satisfactorily coated. Brittle deposits are eliminated, as there is no appreciable alloying of zinc and basis metal*. Furthermore, due to the absence of heat, the basis metal is not warped, and its temper is not impaired. The electroplating process yields coatings of sufficient ductility to permit drawing or bending. Electrogalvanized coatings that adhere well to castings, and other basis metals, are obtained by suitable methods of preparation.

** These statements should not be taken to mean that hot-dip galvanizing is necessarily non-uniform and brittle. It is well known that steel strip and wire, coated continuously, take uniform coatings; and that commercial methods of hot dipping are in use which produce deposits which will withstand drawing and bending.*

The commercially important methods of electrogalvanizing are the following:

(a) **Acid zinc plating.**
(b) **"Rapid zinc process." (zinc chloride—zinc acetate solution.)**
(c) **Cyanide zinc plating. (This includes processes for bright and semi-bright zinc, and the du Pont Ductile Zinc Process.)**
(d) **Hubbell-Weisberg process.**

The growing importance of electrogalvanizing in recent years is well shown in Table I.

TABLE I

Consumption of Zinc by Hot Dipping and Electrogalvanizing Zinc Applied, in Tons

(Minerals Yearbook, U. S. Bureau of Mines, Vols. 1933 to 1941)

Year	Electro-galvanizing (a)	Hot Dip (b)*	Total** (c)	Ratios (b):(a)	Ratios (c):(a)
1933	2500	26,500	148,000	10.6	59.2
1934	1900	24,000	152,000	12.6	80.0
1935	3115***	30,000	195,000	9.6	62.6
1936	4581	36,000	242,000	8.0	52.6
1937	5443	40,000	256,000	7.3	47.0
1938	3978	19,200	198,000	7.3	49.5
1939	5740	40,700	275,000	7.1	48.3
1940	6071	42,200	287,000	7.0	47.3

* On wire and wire cloth only.
** Zinc consumed for all purposes.
*** Johnstown, Pa., Bethanizing plant started.

Acid Zinc Plating

Electroplating with zinc from acid solution is used principally for the production of galvanized steel wire, strip, wire cloth and some hardware and steel castings. Acid electroplating baths are characterized by a high rate of deposition and low operatings costs, and are generally suited for large scale production. Their main disadvantage is their poor throwing power, which limits their application to relatively simple forms. However, moderate throwing power can be obtained by first coating the article in a cyanide "strike" bath, and completing the deposition in the acid bath, although this practice is not often followed.

Where only limited corrosion protection is required, as in the case of box strapping and stapling wire, thin (0.0001 to 0.0005 in.) inexpensive coatings of zinc are employed. A wide range of coatings is used on steel wire, and coatings exceeding 2.4 oz. per sq. ft. (0.004 in. thick) are applied commercially. Wire cloth or screen is usually protected with 0.1 to 0.2 oz. per sq. ft. (0.00017 in. to 0.00034 in. thick) of zinc electroplate, which is frequently coated with varnish for additional protection. Coatings of 0.05 to 0.5 oz. per sq. ft. (0.000085 in. to 0.00085 in. thick) are used on small hardware.

Following are the minimum thicknesses on significant surfaces as spe-

Practice

Sixty-second in a Series of Articles on the Technical and Economic Aspects of Metal Cleaning and Finishing

cified by the American Society for Testing Materials, (A164-40 T).

G. S. ..... 0.001 in.
L. S. ..... 0.0005 in.
R. S. ..... 0.00015 in.

The Galvanizers' Committee of the American Zinc Institute specifies 2 oz. per sq. ft. for the best grade of hot galvanized sheet for general outdoor use. This is an average weight of 1 oz. per sq. ft. on each side of the sheet, and corresponds to an average thickness of 0.0017 in.

The initial letters G, L and R were adopted by the A.S.T.M. as arbitrary designations of grades of plating. The second letter S refers to steel as the base metal; other base metals are indicated by the letters B for brass, C for copper and Z for zinc.

For general outdoor service, except for unusual conditions or some industrial atmospheres, 0.001 in. minimum thickness is probably satisfactory. Sheltered outdoor exposure requires a minimum thickness of 0.0005 in. and for indoor or temporary use only, a minimum of 0.00015 in. will suffice. "Significant surfaces" are those surfaces that are visible and subjected to wear or corrosion, or both; or according to a suggested definition, those surfaces which can be touched by a ¾ in. diameter ball bearing.

Continuous processes are employed for the acid zinc plating of wire and strip. For plating steel castings, and the larger and heavier hardware and parts, racking or wiring is the method commonly used. Plating barrels are employed for bolts, nuts, rivets, washers, nails and other small hardware.

Anodes for acid zinc plating are supplied in three grades of zinc: Prime Western spelter (containing up to 98.5 per cent Zn); Intermediate (99.5 to 99.8 per cent Zn); and High Purity (99.95 to 99.99 per cent Zn). A uniform grain size, which results in an even corrosion of the anode and a minimum of sludge, is obtained by careful casting control.

Considerable difference of opinion exists concerning the type of anode to use. Much work is being done with the Intermediate grades, and some even with Prime Western, but many feel that the absence of heavy metals is essential. It is reported that lead, for example, over 0.02 per cent results in a lead film on the anode which causes high polarization and resistance to the flow of current into the solution. Other impurities also cause more or less trouble. Iron in the quantities normally present in zinc anodes is not detrimental. Following is the spectrographic analysis of an Intermediate grade of zinc anode, of satisfactory quality, according to Lyons:[1] Pb, 0.08 per cent; Cd, 0.08 per cent; Cu, 0.01 per cent; Fe, 0.01 per cent; Mg, 0.005 per cent; Sn, 0.002; Al, trace, and Zn, by difference, 99.81 per cent

[1] *"Acid Zinc Plating" by Ernest H. Lyons, Jr., Modern Electroplating published by the Electrochemical Society, Inc. (1942).*

There also appears to be some difference of opinion as to whether zinc-aluminum alloy anodes or zinc-aluminum-mercury anodes offer any advantages over zinc anodes in the acid bath, although those in favor of zinc-aluminum-mercury anodes point to lower polarization, considerably less sludge and zinc loss, and more stable pH. Wire and sheet steel are sometimes electrogalvanized with insoluble anodes; these are made of lead

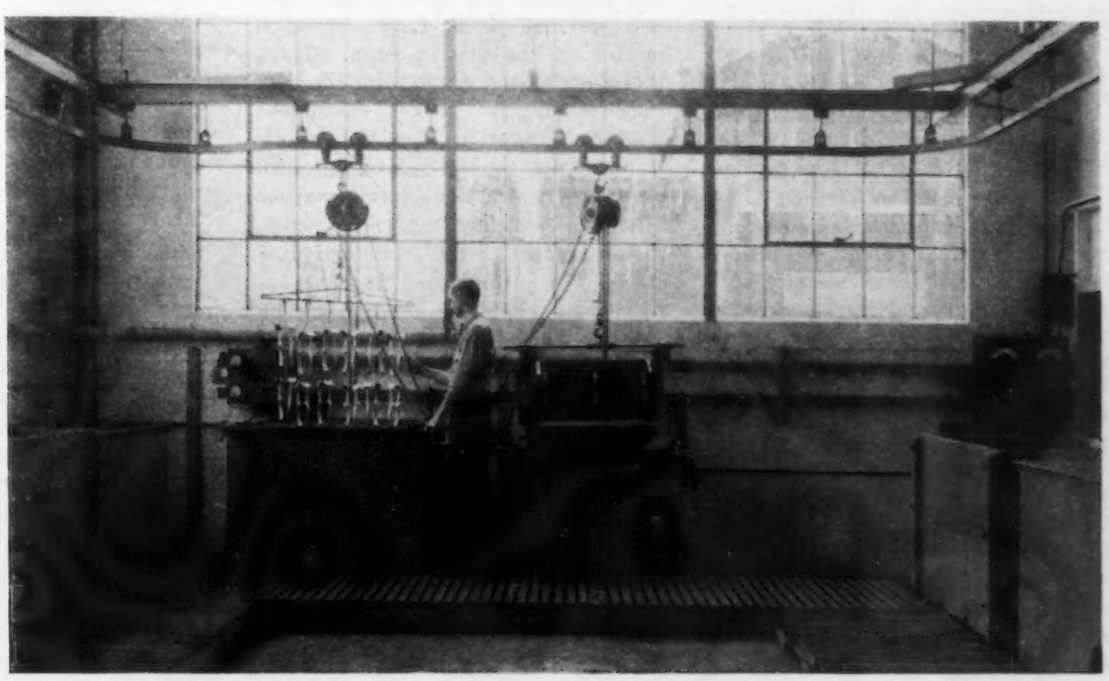

FIG. 1—Part of the plating unit of the York Ice Machinery Co., York, Pa.

(Courtesy, Hanson-Van Winkle-Munning Co.)

containing a small amount of silver, or of silicon-iron, where low current densities are used.

Zinc sulfate forms the basis of most of the acid zinc baths in use today. The commercial grade of zinc sulfate is usually of sufficient purity. Nitrates are an objectionable impurity in the plating bath, as they produce dark, unattractive porous coatings. Sulphuric acid which is added to the bath to lower the pH, should be low in arsenic, as this impurity produces poor deposits. Addition agents that are commonly used are licorice, glucose, dextrin and gelatin. Numerous others have been used, and other substances have been recommended to produce smoother, brighter deposits, or to permit operation with less critical control of temperature, pH and current density.

Following are four approved formulas for acid baths:†

FORMULA NO. 1

	oz. per gal.
Zinc sulfate, $ZnSO_4.7H_2O$	32
Ammonium chloride, NH_4Cl	2
Aluminum sulfate, $Al_2(SO_4)_3.18H_2O$	4
Licorice	0.13

FORMULA NO. 2

	oz. per gal.
Zinc sulfate, $ZnSO_4.7H_2O$	54
Aluminum chloride, $AlCl_3.6H_2O$	3
Sodium sulfate, Na_2SO_4	10

FORMULA NO. 3

	oz. per gal.
Zinc sulfate, $ZnSO_4.7H_2O$	48
Ammonium chloride, NH_4Cl	4
Sodium acetate, $NaC_2H_3O_2.3H_2O$	2
Glucose	16

FORMULA NO. 4

	oz. per gal.
Zinc sulfate, $ZnSO_4.7H_2O$	32
Sodium acetate, $NaC_2H_3O_2.3H_2O$	2
Aluminum sulfate, $Al_2(SO_4)_3.18H_2O$	4
Licorice	0.13

For the operation of plating barrels, the concentration of zinc sulfate should be increased to 72 oz. per gal.

The basis metal is cleaned before plating by the standard methods with very thorough rinsing, to prevent contamination of the pickle, or plating solution. Wire and certain types of cold rolled steel are cleaned by special methods. Overpickling prevents satisfactory zinc plating, and as castings are easily overpickled, they require special treatment. Abrasive cleaning (sand or grit) is recommended as preliminary cleaning for castings. The preferred methods for castings are tumbling with sand and water, or sand-blasting; pickling in weak hydrofluoric acid is sometimes employed as an alternative method. For pickling steel, hydrofluoric acid is used (40 to 50 per cent) at room temperature in preference to sulphuric acid (10 per cent) up to 150 deg. F.

An important element in pickling is to keep the time of immersion of the work short to prevent overpickling; that is from a few seconds to not over 1 min. Anodic pickling is also used in some instances, to activate the surface. Unless the residue from inhibitors are completely removed after pickling, the use of inhibitors is not recommended. A "strike" cleaning in a cyanide bath has a good cleaning effect, due to the alkalinity of the bath, but poor adherence of the acid zinc plate will result unless the cyanide solution is rinsed off thoroughly.

Current Densities

A cathode current density of 10 to 30 amp. per sq. ft. is used for the still tank plating. Current densities may be increased, depending upon the agitation of the solution and the character of the work. In the plating of round wire in special baths, current densities up to 2000 amp. per sq. ft. are employed. Bath temperatures should be between 75 deg. and 85 deg. F., as deposits become duller, darker and coarser above 100 deg. F. In some cases, artificial cooling is used when high current densities are employed. Acid zinc solutions are usually operated at pH 3.5 to 4.5, as determined by electrometric measurement. To obtain uniform results, the pH should not fluctuate more than 0.3 unit. High pH values, usually above 5.0 are used for barrel plating, except when aluminum sulphate is used since it precipitates. In this case, the pH may be 3.5 to 4.0, electrometric.

Roughness, pitting and discolored deposits may result from suspended matter in the plating bath. It is, therefore, customary to filter the bath continuously for large, continuous plating installations, but this refinement is not generally used for still plating in which the solution may be filtered periodically, say once a week. As an adjunct to filtration, activated charcoal has been used at times to remove oils and other impurities. Organic addition agents may also be removed by its use. Metallic impurities in baths give some trouble, but the metals are deposited by replacement on the zinc anodes, when the equipment is idle. The anodes should be taken out of the bath at intervals, treated with acid and scrubbed in order to remove these deposited impurities.

Iron is frequently introduced in the bath by insufficient rinsing after pickling the work. An iron content of a few grams per liter is not considered objectionable, but higher concentrations may contaminate the zinc deposit with iron. Iron may be removed from the bath by oxidization to the ferric state by bubbling air through the liquid, or by adding hydrogen peroxide, manganese dioxide, or persulphates. The ferric salts precipitate as ferric hydroxide, as the bath pH tends to rise when electrodeposition is not in progress. Other impurities such as antimony and arsenic, which may be present in small amounts, also precipitate with the ferric hydroxide.

As the pH of the bath increases, due to the reaction between the free acid and the zinc anodes, it is necessary to add sulphuric acid in order to maintain the optimum pH of 3.5 to 4.5 (Zinc-aluminum mercury anodes, it is stated, eliminate this necessity). It is sometimes necessary to add zinc sulfate to the bath, if the zinc content has been depleted due to excessive drag-out losses. These losses may also necessitate the addition of other components in the bath. When operating with insoluble anodes, acid is liberated at the anode, and the bath becomes depleted of zinc. The bath is restored to its normal condition by dissolving scrap zinc, zinc dust, or zinc oxide in calcined zinc ore, in the accumulated acid. This method is used for galvanized wire and sheet steel, bath impurities being removed by oxidation, neutralization and treatment with zinc dust.

A difficulty that is encountered at times is the precipitation of a crust of basic zinc, iron, lead and aluminum compounds on low-purity, unalloyed anodes. This condition, which is due to local consumption of acid at the anodes, does not affect anode efficiency seriously, but does increase the ohmic resistance at the anode. This current loss may be decreased by lowering the bath pH, or by agitating the solution near the anode.

The control of acid zinc baths is usually limited to pH determination and an estimation of zinc content by means of specific gravity, but this method is not effective with aluminum sulphate or chloride present. Titration of the zinc is most satisfactory. The quinhydrone or glass electrode is well suited for pH determination, but approximate values may be obtained by colorimetric methods or test papers.

It is not customary to buff and polish the deposited zinc, although in some cases the zinc coating is given a light brushing or rolling. After-

treatment by the Cronak Process is discussed elsewhere in this article.

Cathode efficiencies of approximately 99 per cent can be obtained commercially. At both anode and cathode, the polarization is quite low (less than 0.1 volt). The throwing power of acid zinc baths is poor in comparison with cyanide zinc baths, but this deficiency may be remedied to some extent by first coating the work in a "strike" cyanide zinc bath. The deposits obtained in acid zinc baths are usually whiter than those produced in cyanide baths and, although they are sometimes coarse-grained, there is no great difference in protective value between zinc deposited from acid and alkaline solutions if a given minimum thickness of zinc is applied.

Testing Coating Thicknesses

Determination of the thickness or weight of the zinc coating is the most significant test, as the amount of metal deposited is one of the main factors in the length of life. The American Society for Testing Materials has approved the microscope test for thickness, but it is not widely used since it is too slow and involved for commercial application. Average thickness can be determined most reliably by the strip test. The stripping solution is prepared by adding 5 c.c. of a solution (containing 20 grams of antimony oxide per liter of hydrochloric acid) to 100 c.c. hydrochloric acid (sp. gr. 1.19). The area of the sample and loss in weight of dissolved zinc are observed, and from these data the average coating thickness is calculated.

Magnetic methods are used to some extent for determining coating thickness at a given point, but this is usually determined by a dropping test. One method employs a solution of ammonium nitrate 100 grams per liter and nitric acid (sp. gr. 1.42) 55 grams per liter; the reagent is used at 23 to 27 deg. C. An alternate method uses a solution of chromic acid 200 grams per liter and sulphuric acid 50 grams per liter; this solution is used at 22 deg. C. In either case the solution is dropped at the rate of 90 to 110 drops a minute and each second required, until the steel base is exposed, represents a zinc thickness of 0.00001 in. The precision of this test is said to be within 20 per cent, although at times it is difficult to determine the endpoint.

To test the adhesion, the plated work is bent in various ways, and the coating is then examined for cracks and peeling.

The salt spray test has been used extensively as an accelerated corrosion test, but many authorities now consider it to be of very limited value. Although the copper sulfate, or Preece test is still widely used to determine uniformity of coating thickness, its utility has also been questioned.

TABLE II

Effect of Addition Agents in Bright Zinc Baths

	Addition Agents	oz. per gal.	Purpose or Effect
(1)	Ammonium thiocyanate-formaldehyde resin Phenol-thiocyanate Thiourea-formaldehyde resin (U. S. Pat. 2,101,580; 2,101,581. Henrichs to Udylite Corp.)	0.06 to 0.13	Improves brightness; increases tolerance of Cu, Ni, Pb and Cd in bath.
(2)	Methyl-ethyl ketone (conditioned with sulfuric acid or not conditioned) (U. S. Pat. 2,109,887. Mattacotti to Hanson-Van Winkle-Munning Co.)	1.3 fl. oz. per gal. to 3.3 fl. oz. per gal.	Improves brightness
(3)	Molybdic oxide and similar compounds (U. S. Pat. 2,080,520. Westbrook to E. I. du Pont de Nemours & Co.)	0.33 to 1.0	Produces bright deposits directly from bath.
(4)	Piperonal or other methylene dioxyphenyl compound (U. S. Pat. 2,218,734; 2,233,500. Westbrook to E. I. du Pont de Nemours & Co.)	0.4	Improves brightness, especially with molybdenum, at low current density.
(5)	Gelatin with certain oxyheterocyclic compounds (U. S. Pat. 2,196,588. Hull to E. I. du Pont de Nemours & Co.)	0.13	Improves rate of covering
(6)	Thiourea with metal brightener (U. S. Pat. 2,080,479, Hoff; 2,080,483 Hull; 2,080,520 Westbrook to E. I. du Pont de Nemours & Co.)	1.0	Improves brightness
(7)	Polyvinyl alcohol in conjunction with bath purification (U. S. Pat. 2,171,842. Wernlund to E. I. du Pont de Nemours & Co.)	0.02	Improves brightness and covering power, particularly in barrel plating.

The Rapid Zinc Process

Hanson-Van Winkle-Munning Co. has developed a new type of acid bath and method of application, which they term the "Rapid Zinc Process".[1] Due to the ductility of the deposits, it is stated that even in the case of thick coatings on steel, they may be severely deformed without rupture. Two important applications are found in the manufacture of ridged roofing and in plating wire.

For construction of electroplating tanks, the company recommends the use of rubber-lined steel, ceramic ware or tempered glass. Heat exchangers, made of Pyrex, Duriron, or Karbate or heating coils of ceramic or Karbate, may be used for heating the plating bath. The solution should be filtered before use, but as the anodes produce very little sludge, continuous or frequent filtration is considered unnecessary, unless there is contamination by dirt and dust dropping into the bath. Filters are constructed preferably of stainless steel, or are rubber covered. Turbulence, or rate of solution flow, is an important factor in the successful operation of this process. Good results are obtained with a directed discharge from a centrifugal pump, or by means of a submerged propeller in a housing which directs the flow.

The plating bath formula is simple, consisting of a solution of only zinc chloride and zinc acetate without addition agents. Used with zinc-aluminum alloy anodes, no corrosion proceeds when plating is not in progress.

Current densities range from 40 to 1000 amp. per sq. ft., depending upon the nature of the work. A density of 40 to 100 amp. per sq. ft. is employed for depositing zinc on steel parts of simple design. Steel sheets 3 to 6 ft. wide can be electrogalvanized at 400 to 500 amp. per sq. ft. Wire can be plated at 1000 amp. per sq. ft. The optimum bath temperature is 120 deg. F., but a range of 100 deg. to 130 deg. F. is permissible. Bath pH while plating is 3.6 electrometric or 4.1 colorimetric. For the recommended anode-cathode spacing, required voltages range from 3, at the lowest current density, to 15 volts for a density of 1000 amp. per sq. ft. These spacings

[1] *Myron B. Diggin, "Recent Developments in Zinc Plating," Monthly Review, American Electroplaters' Society, 30, pages 249 to 270 (March, 1943).*

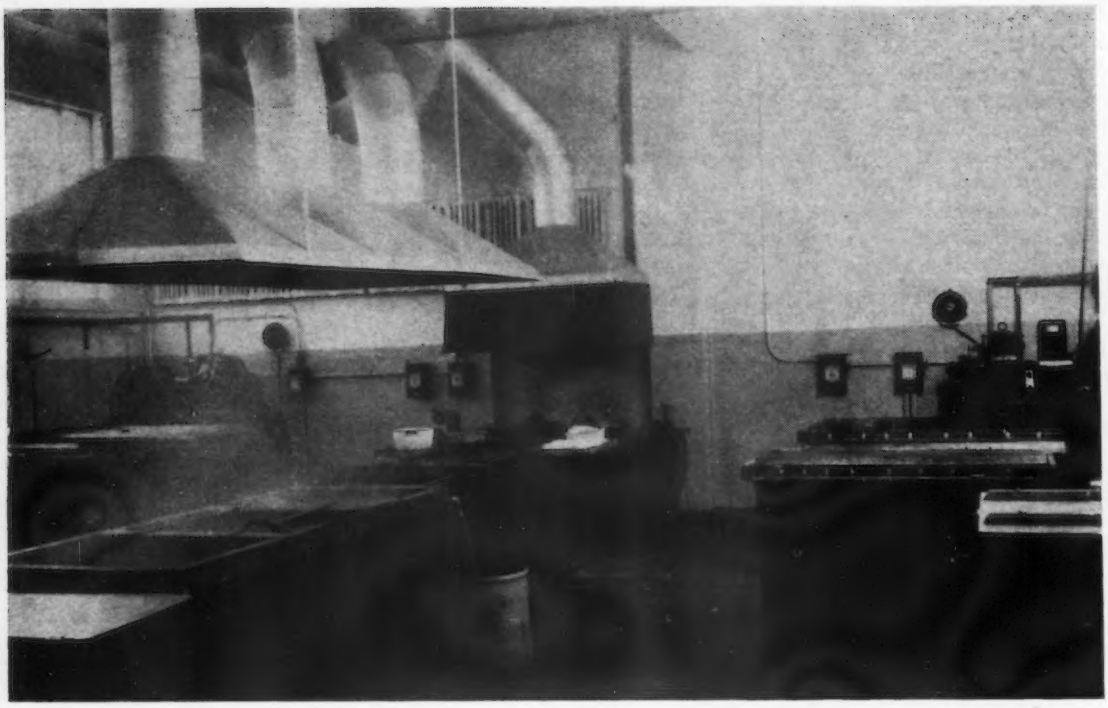

FIG. 2—Plating plant of the Dictagraph Corp., Jamaica, N. Y.

(Courtesy, Hanson-Van Winkle-Munning Co.)

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are ½ in. to 2 in. at over 100 amp. per sq. ft. and 4 in. to 8 in. below 100 amp. These conditions are especially adaptable to simple shapes—sheet, strip, wire, etc.

The process includes a simple method of analysis for bath control. Due to the stability of the bath constituents and anode and cathode efficiencies of practically 100 per cent, it is said that solution pH remains nearly constant.

Cyanide Zinc Plating [3, 4, 5, 6]

Deposits can be obtained in straight cyanide baths at varying rates up to 0.005 to 0.006 in. thickness per hour, at 100 amp. per sq. ft. with a cathode current efficiency of 90 to 95 per cent. In the modified bath for rapid deposition, the efficiency is 85 to 95 per cent. The zinc-mercury bath, when operated at a current density of 25 amp. per sq. ft. has 90 per cent cathode current efficiency. Bright zinc baths operate with efficiencies of 75 to 95 per cent.

The advantages of cyanide bath processes for zinc plating are the following:

(1) High throwing power, which permits plating deep angles, recesses, etc., and produces deposits of uniform thickness.

(2) Semi-bright to mirror-bright deposits can be obtained. These coatings are of excellent appearance and have relatively little tendency to stain during rinsing and drying during assembly operations, and upon exposure to the atmosphere.

(3) Equipment cost is relatively low, as steel tanks may be used.

(4) Plain steel auxiliary anodes can be used for plating in holes and recesses.

The disadvantages of cyanide plating are:

(1) The rate of deposition is lower than with acid baths.

(2) Both the initial and maintenance costs of cyanide solutions are higher.

Cyanide zinc baths are classified as: (1) the straight cyanide bath; (2) the zinc-mercury bath[7]; (3) semi-bright and bright zinc baths, giving ductile deposits, and (4) du Pont Ductile Zinc Process.[8]

The field of application for the straight cyanide bath is primarily protection against rust, as the appearance of the deposits is not particularly atractive. Malleable iron and cast iron do not plate readily in this bath. The zinc-mercury bath is characterized by good covering power at low current densities, good throwing power, uniformity of deposit and ability to coat many basis metals. However, it is not recommended for coating cast iron or malleable iron as a rule; and it may produce season cracking of brass. The bright zinc baths yield products having both good appearance and good rust resistance.

Clean steel or rubber lined steel tanks should be used for bright zinc plating, as wood or lead-lined tanks are not satisfactory. Tanks for barrel plating should have a capacity of 150 to 175 gal., with coils installed for cooling during hot weather. Hard rubber, rubber covered steel and bakelite are satisfactory materials for barrel plating cylinders, but wood and fiber cylinders are not recommended. Steel angles should be used to cover copper or brass bus bars, to protect them from corrosion by any plating solution that may drop on them. Capacity of tank rheostats should be sufficient to supply current densities of 5 to 50 amp. per sq. ft. for still plating, and 250 to 450 amp. per unit for barrel plating. Barrel plated material may be bright dipped in clean steel baskets, or preferably in rubber covered steel baskets. The solution for bright dipping should be contained in rubber lined steel tanks or stoneware vessels, as metal tanks are unsatisfactory. The solution for ductile zinc plating

[3] *R. O. Hull and C. J. Wernlund, "Cyanide Zinc Plating Baths," Modern Electroplating. Special volume published by the Electrochemical Society, Inc. (1942).*

[4] *"Du Pont Bright Zinc Operating Manual," issued by the Electroplating Division, E. I. du Pont de Nemours & Co.*

[5] *Zin-OLyte Zinc Molybdenum Plating Salts," a technical service manual issued by E. I. du Pont de Nemours & Co.*

[6] *"Ductile Zinc" issued by the Electroplating Division, E. I. du Pont de Nemours & Co.*

[7] *Abraham Van Winkle, U. S. Pat. 901,758; Proctor and Wernlund, U. S. Pat. 1,435,875; J. Haas, Jr., U. S. Pat. 1,451,543 and 1,497,265.*

[8] *E. I. du Pont de Nemours & Co. (Oplinger), U. S. Pat. 2,075,623; 2,146,439.*

should be circulated four times an hour by a pump of adequate capacity. The solution enters the tank through seamless iron pipes, containing 1/16 in. holes spaced 12 in. to 18 in., placed at the bottom of the plating tank.

For use in the straight cyanide bath, high purity zinc anodes such as Special High Grade or High Grade, are recommended. Anodes of Intermediate or Prime Western zinc, alloyed with 0.5 to 1.0 per cent mercury, are employed in the zinc cyanide-mercury bath. Baths for bright zinc plating should be supplied with anodes of high purity zinc, such as Special High Grade or High Grade, or of zinc alloyed with such metals as aluminum, calcium or magnesium, which do not plate out.

Following are two approved formulae for the straight cyanide zinc bath[3]:

FORMULA NO. 5

	oz. per gal.
Zinc cyanide, $Zn(CN)_2$	8
Sodium cyanide, NaCN	3
Sodium hydroxide (caustic soda) NaOH	7

A modification of this formula to permit rapid deposition at high cathode current efficiency is the following:

FORMULA NO. 6

	oz. per gal.
Zinc cyanide, Zn(CN)	12
Sodium cyanide, NaCN	5
Sodium hydroxide (caustic soda) NaOH	12

Formulas for the zinc-mercury process resemble the cyanide formulas, but with the addition of a small amount of a mercuric compound, such as mercuric chloride, or mercuric oxide dissolved in sodium cyanide solution. Formula No. 7 is used in still plating, and Formula No. 8 is employed in plating barrels.

FORMULA NO. 7

	oz. per gal.
Zinc cyanide, $Zn(CN)_2$	5
Sodium cyanide, NaCN	3
Sodium hydroxide (caustic soda) NaOH	4
Mercuric compound	0.003

FORMULA NO. 8

	oz. per gal.
Zinc cyanide, $Zn(CN)_2$	8
Sodium cyanide, NaCN	4
Sodium hydroxide (caustic soda) NaOH	6
Mercuric compound (see notes above)	0.03

NaCN to Zn Ratio

The concentrations of components for bright zinc plate baths may be varied through a wide range, as indicated in the following formulas. However, it is important to maintain definite ratios (M) between the concentration of total sodium cyanide and the concentration of zinc content. For still plating, the ratio (M) should be between 2.0 and 3.0. In the case of barrel plating, the ratio (M) lies in the range 2.5 to 3.2. A bath composition for still plating and barrel plating is given in Formula No. 9.

Formula No. 10 is given by E. I. du Pont de Nemours & Co. in their "Du Pont Zinc Operating Manual."

FORMULA NO. 10

	oz. per gal.
Zinc cyanide, $Zn(CN)_2$	8
Sodium cyanide, NaCN	5.6
Sodium hydroxide (caustic soda) NaOH	10.4
Sodium sulfide, Na_2S	1/15
RH-309 (Purozinc Brightener)	⅛

Matte-white, ductile zinc deposits are obtained with du Pont's patented process, which employs the bath composition of Formula No. 11.

FORMULA NO. 11

	oz. per gal.
Zinc cyanide, $Zn(CN)_2$	12
Sodium cyanide (NaCN)	5
Sodium hydroxide (caustic soda) NaOH	11
Sodium sulfide, Na_2S	0.1

Steel is prepared for plating in the usual alkaline cleaner, followed by an acid pickle, taking care to avoid overpickling. Hot rolled steel generally requires heavy pickling, whereas only very mild pickling is usually needed for cold rolled steel. Hydrochloric acid is preferred for pickling the latter, although sulphuric acid may be used in some cases. Hot sulphuric acid is generally used for heavily scaled steel. The work should be well

FORMULA NO. 9

	Range oz. per gal.	Suggested oz. per gal.
Zinc cyanide, $Zn(CN)_2$	8.0 to 11.0	8.0
Sodium cyanide, NaCN	2.5 to 8.5	5.6
Sodium hydroxide (caustic soda) NAOH	10.0 to 15.0	10.5
Corresponding zinc content	4.5 to 6.0	4.5
Total equivalent sodium cyanide	9 to 18	12.3

From Plating and Finishing Guidebook, 1943.

The addition agents that are commonly used in bright zinc baths are listed in Table II. All of these products are the subjects of patents.

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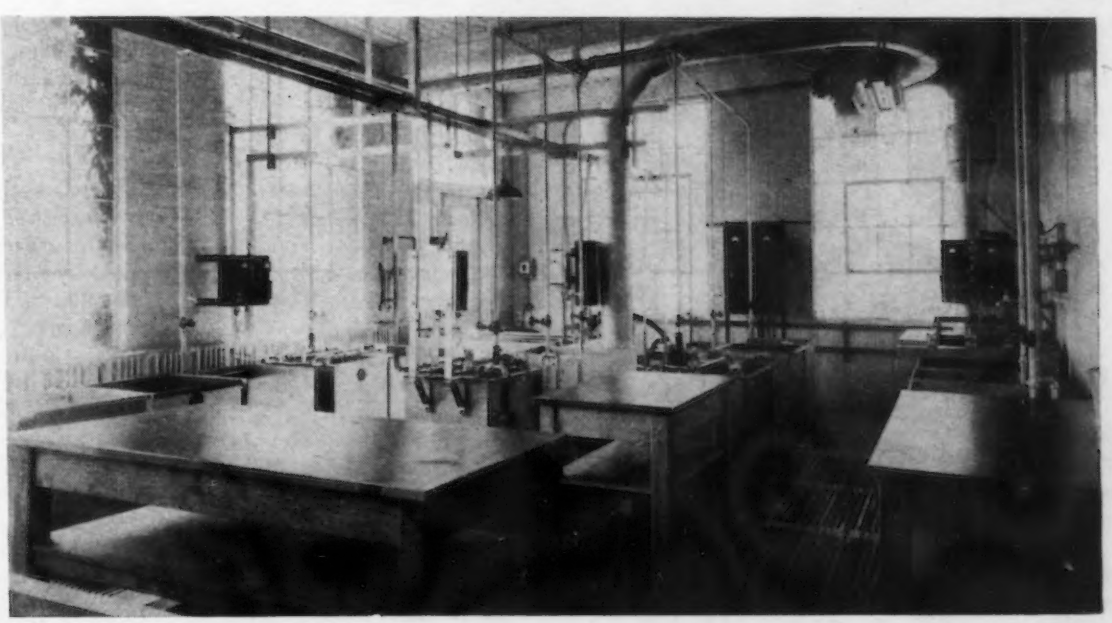

FIG. 3 — Plating room of the Colonial Bronze Co. Photograph by Flieg & Newbury.

(Courtesy, Hanson-Van Winkle-Munning Co.)

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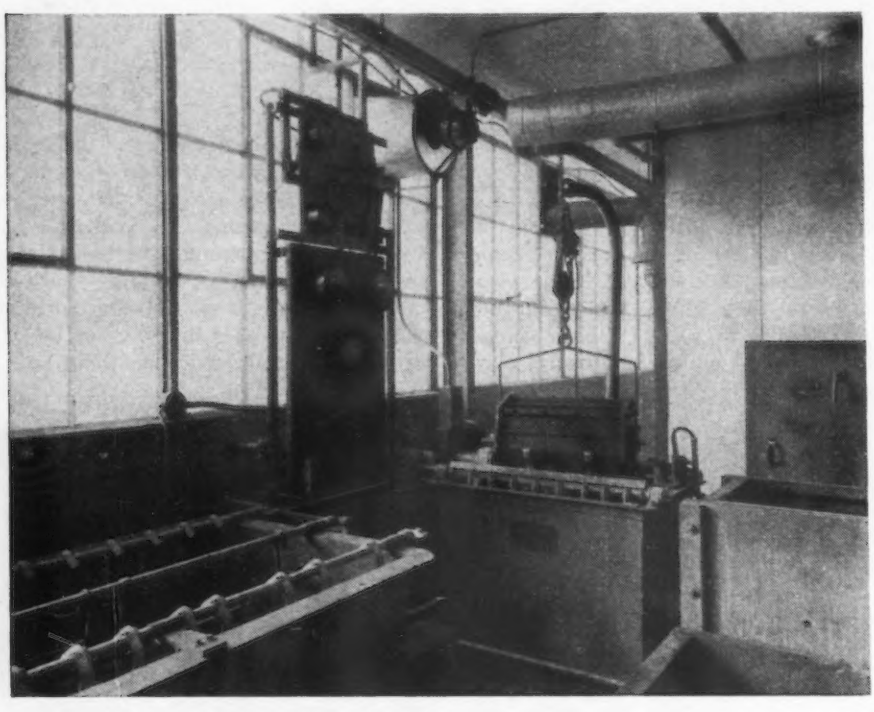
rinsed in water after pickling. This may be followed by soaking in cold sodium cyanide solution (4 to 6 oz. NaCN per gal.), for 1 to 3 min., and then transferring to the plating bath. When it is necessary to hold cleaned work before plating, it can be stored in this cyanide solution to prevent rusting. Smut due to pickling may be removed by anodic cleaning.

Castings are frequently difficult to plate, but machined or ground surfaces yield better results than sand-blasted or shot-blasted work, and this in turn is better than treatment by pickling. When the use of cadmium is permitted, castings may be zinc plated after coating with a flash of cadmium, but this necessitates extra equipment and operations. Another method for plating gray and malleable castings is to strike in a bath of the following composition:



(Courtesy, Hanson-Van Winkle-Munning Co.)

Fig. 4—Still and barrel plating installation of the Sikorsky Aviation Corp.

FORMULA NO. 12

	oz. per gal.
Zinc cyanide, $Zn(CN)_2$	8
Sodium cyanide, NaCN	5
Sodium hydroxide (caustic soda) NaOH	11
Sodium carbonate, Na_2CO_3	5
Ketonic Brightener	66 cc. per gal.

A current density of 125 amp. per sq. ft. is applied for 1 to 2 min., and the work is then transferred to a zinc plating bath of the same composition as the strike bath.

The du Pont technical service manual for "Zin-O-Lyte" zinc-molybdenum plating salts recommends the following cleaner, either for soaking or for electrocleaning:

	oz. per gal.
Sodium hydroxide (caustic soda) NaOH	4
Soda ash, Na_2CO_3	2
Trisodium phosphate, Na_3PO_4	2

In electrocleaning, the cleaner is used at 190 deg. F. with a current density range of 20 to 80 amp. per sq. ft., first making the work cathodic for 2 or 3 min. then anodic for 10 to 20 sec.

Cyanide zinc baths operate best in the pH range 12.2 to 12.7. The *straight cyanide bath* should be held at a temperature between 104 deg. and 122 deg. F., using a current density of 9.3 to 19 amp. per sq. ft. The *modified straight cyanide bath* for rapid deposition (Formula No. 6) employs current densities of 55 to 110 amp. per sq. ft., with a temperature range of 104 deg. to 158 deg. F. For the zinc-mercury bath (Formulas No. 7 and 8), a maximum cathode current density of 40 amp. per sq. ft. with an anode current density of 10 to 15 amp. per sq. ft. is used. The temperature range is 86 deg. to 122 deg. F., the optimum being 104 deg. F. Bright zinc baths may be operated between 68 deg. and 113 deg. F., but preferably between 82 deg. and 100 deg. F. Cathode current density may range from as low as 2 up to 100 amp. per sq. ft. although the average limits are 10 and 50 amp. per sq. ft. The anode current density is 10 to 30 amp. per sq. ft. Operating conditions for du Pont bright zinc baths are: For still plating, 10 to 60 amp. per sq. ft. cathode current density, with temperature between 60 deg. and 113 deg. F.; for barrel plating, the maximum cathode current density obtainable is used at a voltage of 8 to 15 across the bus bars, and a temperature of 68 deg. to 113 deg. F. The *du Pont ductile zinc process* is operated between 115 deg. and 120 deg. F., with normal limits of 10 to 50 amp. per sq. ft. cathode current density for still plating, and 25 to 100 amp. per sq. ft. when either the cathode or the solution is agitated.

Control of Bath Composition

The control of two factors in cyanide bath composition is essential for satisfactory operation. These factors are:

(1) Sodium hydroxide concentration.

(2) The ratio M of total sodium cyanide to zinc content. Total sodium cyanide is equal to the actual sodium cyanide, plus the sodium cyanide equivalent of zinc cyanide.

For straight cyanide zinc, Formulas No. 5 and 6 should be maintained within ±10 per cent. The ratio M of total sodium cyanide to zinc should be within the range 2.0 to 2.5 for Formula No. 5, and between 2.2 and 2.6 for Formula No. 6.

Constituents of the zinc-mercury baths, Formulas No. 7 and 8, should also be held within ±10 per cent. Mercury cyanide concentration should be within the limits 0.013 to 0.027 oz. per gal. As mercury metal deposits on the anodes during shutdowns, it is necessary to replace this by addition of mercuric compounds to the bath. Excessive concentration of zinc in the bath may be corrected by replacing about one-third of the zinc anodes with steel anodes, preferably case-hardened. The bath should be filtered occasionally, to remove ferric hydroxide and the other suspended matter.

Bright zinc baths require more careful attention than the straight cyanide or zinc-mercury baths. The first requirement is that heavy metal impurities must be almost completely eliminated. Lead is precipitated by the addition of sodium sulfide in concentrated solution, using 0.033 to 0.33 oz. of the sulfide for each gallon of plating solution. Copper is removed by adding 0.033 to 0.33 oz. zinc dust per gal. and then stirring well and filtering.

As a second requirement, the ratio M must be maintained within certain limits. The optimum values of the ra-

tio M of total sodium cyanide to zinc, for various temperature ranges are as follows:

Temperature deg. F.	Ratio M—Optimum
82 to 87	2.6
88 to 92	2.8
93 to 100	3.0

The optimum concentration of sodium hydroxide is given in Formula No. 9, but bright deposits can be obtained within the range 8 to 20 oz. per gal. For the normal operation of the du Pont bright zinc bath (Formula No. 10), the ratio M should be 2.75, although this may be varied for certain applications. A ratio M of 2.2 is employed in the operation of the du Pont ductile zinc bath (Formula No. 11).

The Hanson-Van Winkle-Munning Semi-Bright Zinc plating solution produces deposits which range from semi-bright to bright, the degree of luster depending upon operating conditions. The deposits are highly ductile and are pure unalloyed electrolytic zinc and are therefore highly protective. For highest luster and surface uniformity, bright dipping the deposits is recommended.

FORMULA NO. 13

	oz. per gal.
Zinc cyanide	8
Sodium cyanide	5
Sodium hydroxide	12
Zinc addition agent S-B	0.8

Which will analyze when in solution, approximately:

	oz. per gal.
Zinc	4.5
Total sodium cyanide	12.0
Sodium hydroxide	12.0

It is essential that all heavy metal impurities be excluded from this solution. If the deposits come from the bath with a dark color or if the deposits show a dark or streaked appearance after bright dipping, impurities are present.

The permissible cathode current density of solution No. 13 is high; it is a high speed plating bath. Good results are obtained with a cathode current density of from 10 to 40 amp. per sq. ft. with an optimum of 30 amp. per sq. ft. Below 20 amp. per sq. ft. there is a noticeable diminution of deposit luster.

A voltage at the tank of between 2½ and 3½ volts is required to insure proper operation of the solution. With a current source of 6 volts, a 3 volt drop rheostat is recommended.

Solution No. 13 produces deposits of highest luster when operated at around 70 deg. F. At 70 deg. F. and at a current density of 30 amp. per sq. ft. the cathode efficiency is approximately 86 per cent.

Zinc-aluminum anodes are recommended in this solution.

After the work has been plated it is necessary to rinse thoroughly before the bright dip. This rinsing is important as the highly caustic film of plating solution is difficult to remove and if any remains there is a possibility of obtaining dark and streaked work. The rinse water should be clean. Staining will occur if nickel, cadmium or copper from previous rinsing operations is carried into the bright dip.

The work is immersed for a few seconds in the bright dip which consists of a 0.5 per cent nitric acid solution.

The work is again rinsed in cold water, hot water and then dried.

Ed. Note: Next week concludes with data on bright dipping, the Hubbell-Weisberg process, etc.

Post-War Uses Seen for Nylon Plastic

NYLON, now used for several secret military purposes, will enter a vast, new field as a plastic after the war, according to E. I. duPont de Nemours & Co. The new material is a thermoplastic, which means that under heat and pressure it can be reshaped and reformed any number of times. The softening point for most thermosetting materials is about 160 deg. F.; the highest previous limit was about 280 deg. F.; Nylon's is 450 deg. F., approaching that of thermosetting materials which cannot be remolded once they are formed under heat and pressure.

Its toughness is particularly useful where thin sections with great strength are required. It is light in weight; burns slowly; undergoes little or no deterioration with age; is only slightly affected by sunlight; resists oil, grease, solvents, alkalis and weak acids; is easily machined; has good elastic properties; and can be molded with existing equipment with minor modifications.

All Nylon now is strictly allotted for military and essential civilian requirements. The bulk goes into fibers for parachute cloth, bomber tire cords and glider rope, and into large, single strands for brush bristles and surgical sutures.

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BARS, tubing of large and small diameter, cords, sheet or strip, woven fabric or molded shapes, are some of the varied forms shown here in which Nylon plastic will be available generally after the war. Present day uses are chiefly military.

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Production Surface Grinding

MANY factors must be kept in mind when attempting to grind a surface with a finish expressed in terms of micro-inches, especially when flatness, parallelism and dimensional accuracy must be maintained at a production rate equal to requirements applicable to fixed gages, forming tools and the like. Such a feat is of course now definitely possible, but results are governed more by what is built into the machine than by extended operator experience or a particular technique which might have some effects in his acquiring advanced skill. How fast a 3, 6 or 10 micro-in. finish can be derived without sacrificing any of allied essentials, depends 75 per cent on the extent of development of the equipment and 25 per cent on the application of basic rules for precision grinding.

Any surface grinding machine of the horizonal spindle and traverse table type is obviously intended for fine precision work; otherwise a shaper or planer would do just as well. It is also assumed that this precision will repeat itself from day to day or the unit will not prove a trustworthy production tool. One cannot expect to obtain, simultaneously, high production rate and three-way accuracy unless the machine used incorporates certain characteristics.

Primarily, where vibration exists there can be no precision in a complete form; hence ample but not excessive weight is the major essential. Weight by itself, however, means absolutely nothing unless it be properly distributed so all members will combine and function as a unit 100 per cent in balance.

All "Play" Eliminated

All components must be developed to the highest degree of effectiveness in support of that weight. They must be expertly machined and fitted and this is especially true of the sliding surfaces of table, saddle and vertical ways. Ample area and wide spacing of ways are most significant if the many hours spent in hand scraping and fitting to remove play are to prove most effective in maintaining the accuracy of the machine over a long period of time.

The most frequent source of vibration is traceable to the spindle, even though it might be of direct drive construction. To be virbration-free and therefore deliver maximum accuracy, the spindle must necessarily be both staticly and dynamically balanced. Obviously, this also applies to the motor when an integral construction is used. For long life and greatest efficiency, ball bearings used in a particular spindle should be of the same production lot. A recent improvement along these lines is the mounting of the ball bearings in such a way that the contact between balls and races changes with each revolution of the bearing. The balls thus wear evenly and retain their true spherical shape.

A dependable hydraulic longitudinal and cross feed mechanism is an asset for maximum production and 100 per cent precision. When a magnetic chuck is being used to full or nearly full capacity, Fig. 1, with fluid power as a propelling agent there is no chance of distorting both ends of the surface being ground as is usually the case with rack and pinion construction when the table is being operated automatically. With a hydraulically operated table having a cushioned cut-off at the end of each longitudinal stroke, the only sensation one feels when touching the table is a vibrationless traverse motion.

Generally speaking, there is sufficient "jump" with a table operated with rack and pinion to develop a certain amount of vibration that will find its way to the spindle and cause plenty of trouble. This is indeed true if vibration from table reverse is amplified by a column that is of light construction.

An improperly functioning forced feed lubricating system is something else that will affect the finish considerably. Adjustments must be so that the oil will flow at a rate sufficient to lubricate properly but not great enough to build up pressure between the sliding members. The lubricating and hydraulic systems re-

THE test for efficient performance of a surface grinding machine of the horizontal spindle and traverse table type is determined by the accuracy it will simultaneously impart to a full chuck load of parts.

To Micro-Inch Finish

By H. J. CHAMBERLAND
The Doall Co.

. . . After outlining machine requirements, the author discusses a number of factors relating to magnetic chuck design and usage and the part the proper selection of coolant plays in obtaining high precision and fine surface finish.

main at their best when using only oils recommended by the manufacturer of the machine.

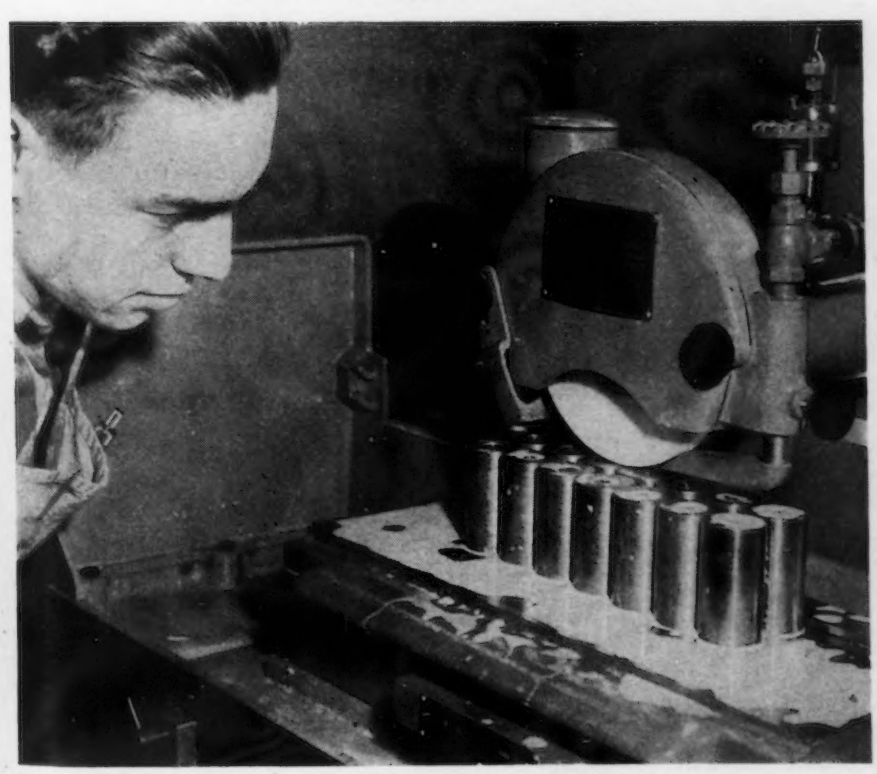
Magnetic Chuck Considerations

Magnetic chucks play a prominent part with tool room and parts production surface grinding. Their respective electrical and magnetic characteristics have much to do in limiting or extending the efficiency of the machine.

When a piece of steel is in a magnetic field, such as the pole pieces of a magnetic chuck, it is carrying all magnetic lines of force possible and is said to be saturated. In this condition no further electrical power is required to maintain the lines of force, so once the power is turned on, the only power consumed in a magnetic chuck is the current lost in the heat of the current passing through the coils. The magnetic lines of force in the pole piece will be dissipated, however, if the current is turned off and at a rate depending on the type of steel used in the pole pieces.

Since the total pull of the chuck is dependent on the sum of the magnetic field about each turn of the coil, it is essential there be as many turns as possible around each pole piece. If the pole pieces are too small, they will not carry sufficient magnetic lines of force to create a strong pull on the surface of the chuck. Therefore, the cross-section of the steel into which the magnetic lines of force pass through the pole pieces and the body of the chuck must be in accord with the magnetic lines of force generated by the coils. It is for this reason that the body of the chuck housing the pole pieces and coils, as well as the top plate of the chuck, must be made of a very good grade of annealed mild steel and solid in section to offer a path of low resistance to the magnetic field. Furthermore, insulation of the electrical coils must be of the highest order since grinding operations require a flood of coolant over the surface of the chuck.

FLATNESS and parallelism as applied to dimensional accuracy depend on coordination of traverse, transverse and vertical feeds. Absolute precision is expected from any intermediate height of the vertical range.

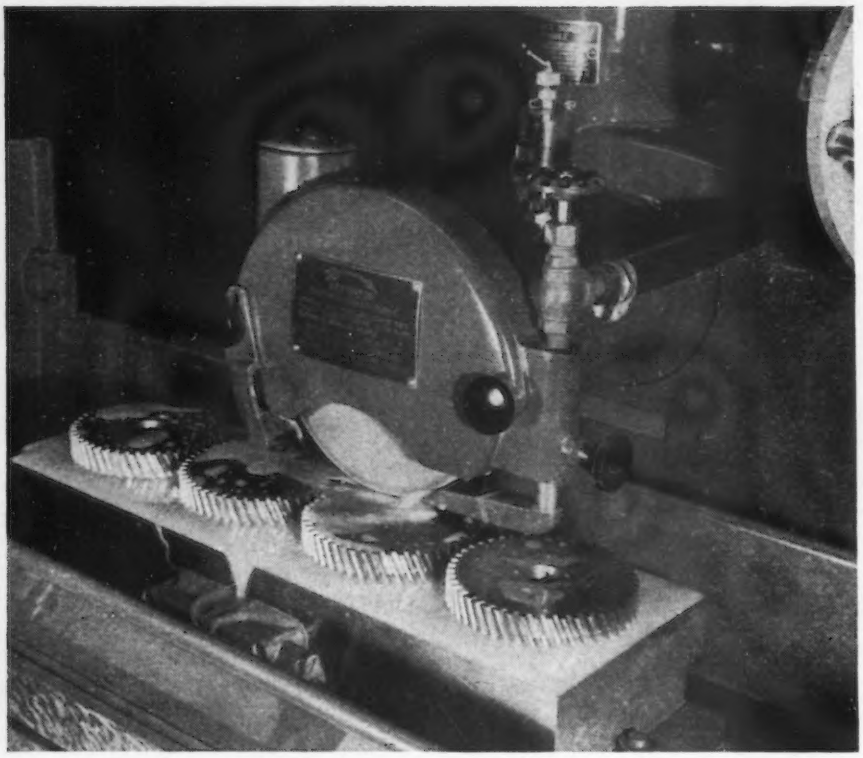


Controlling Residual Magnetism

It is well known that a piece of steel retains its magnetism after the current has been shut off. This residual magnetism always has been more or less a cause for trouble since the work continues to hold to the chuck. Most scratches and nicks on magnetic chucks are caused unintentionally from trying to release the work. The amount of residual magnetism depends on the type of steel being ground. Soft steels revert back to their original conditions more rapidly than hardened steels and certain alloys.

It is known of course that a magnetic chuck requires a conversion of a.c. power to d.c. power which is accomplished by means of motor-generator sets or rectifiers. A new device known as a Selectron not only supplies the direct current but controls the residual magnetism after the power is turned off. This is accomplished by reversing relays and the effect of cooling of electronic tubes which reduce the current as they cool; with this device, the work can be removed from the chuck in less than 15 sec. as though it had never been magnetized. The amount of magnetic lines of force passing through the work can also be controlled. This is a marked advantage when grinding pieces of work which are warped since the pull of the chuck may be regulated to give just enough power to hold the work and yet not to flatten the warp to be ground out.

Accurate work usually reflects a well kept magnetic chuck. It is good pratice to use a thin sheet of paper under bulky parts if the nature of the operation will permit. A good chuck will not be affected by changes



IF a surface grinder will deliver the following standards of accuracy on a test piece, it can be trusted for high speed production within surprisingly close tolerances: Within 0.00005 in. for size, 0.000015 in. for flatness, 0.00005 in. for parallelism and 3 micro-in. r.m.s. for surface finish.

of temperature and if used with care it should go a long time without resurfacing, unless it has to be frequently removed from the machine table. When resurfacing a magnetic chuck it is most important to use only a grinding wheel recommended for this purpose and secondly, to do the work with the current on since this is the way the surface will be used.

CAN glass be surface ground? This question now arises frequently since the introduction of glass gages. If the equipment can in a specified time produce a micro-inch finish on steel, it will surely produce the desired finish on glass gages as herewith shown.

Coolant Requirements

A superfine finish and precision cannot be obtained without a proper coolant system, even when time is not a factor. When production with precision is at stake, the flow must be ample, well localized and the compound or fluid must be of a nature to dissipate a maximum of the heat caused by the abrading action and thereby maintain an even temperature to minimize distortion. It should be realized that the heat generated between wheel and work often attains a temperature of 2200 deg. F. when grinding the harder steels and 1400 to 1500 deg. with mild steels. It is obvious that such high temperatures require a most dependable coolant system. It is known for instance, that if a piece of steel when removed from the magnetic chuck is found to be heated 75 deg. over normal room temperature, or approximately 150 deg., it will decrease from 0.0004 to 0.0005 in. per in. in measurement when it returns to room temperature. On close precision work, the flow and quality of coolant must therefore be well regulated.

Wet grinding improves finish by flushing away chips produced by the wheel; it also decreases wheel cost since the wheel does not load so rapidly and requires less dressing. There is also the advantage of frequently being able to use a wheel one grade harder than would apply to dry grinding, with no lessening of total efficiency.

Wet grinding settles dust and creates a healthier atmosphere for the operator and other workers around him. Dust prevention is also a major aid in maintaining clean bearing surfaces of the grinder and surrounding machines. Last but not least, wet grinding is a preventive of rust by the oiling action of the ingredients of a dependable coolant solution. It is of course imperative that the coolant tank be designed for complete settling of all metal and wheel particles. The amount of flow or the properties of the coolant mean little unless the recirculation of this objectionable matter is eliminated.

The coolant used for precision surface grinding should be made of an oil which emulsifies readily, has good wetting action and is reasonably free from foaming. These factors help materially in keeping the piece being ground at a relatively cool temperature.

Magnesium Castings Impregnated by New Method

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By S. H. BRAMS
Detroit Editor, THE IRON AGE

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. . . Tung oil forced through castings by direct pressure has many advantages for production runs.

A NEW technique in the impregnation of magnesium castings with tung oil, one of which seems advantageously applicable to production shops, has been developed by the Chevrolet Grey Iron Foundry at Saginaw.

The new method forces the oil through porous sections of castings under direct pressure rather than by autoclave vacuum process. When utilized in production runs, it accomplishes considerable time savings over the previous method and appears to be producing a more satisfactory job. Also of importance in the light of today's scarcity of tung oil is the fact that the new method appears to eliminate a considerable proportion of tung oil waste which has seemed inevitable in the past. Inasmuch as the method depends largely upon precise fixturing of the pieces, it does not appear adaptable to job shops handling a wide variety of shapes.

Concept and execution of the method are both simple. Castings are brought to the impregnation department and heated to 350 deg. F. They are then placed in fixtures which provide feed lines for tung oil into the casting cavities and also allow for overflow lines at the other end of the cavities. The piping of these fixtures brings tung oil, pre-heated to 210 deg. F., into the cavities.

Oil is run into and through the cavity, driving all air out. The overflow valves on outgoing lines are then closed, bringing the oil to a dead end, which is under 90 lb. pressure. The casting is held thus for 10 min. During that time any porosity in the casting will be manifested by a film of oil, which gradually appears on the surface of the metal after having seeped through from the inner cavity. Such porosity is common in magnesium castings.

After the 10 min. stay of the pieces in these fixtures, they are removed and put through a degreasing operation which cleans the tung film from the exterior. They are then allowed to stand from 8 to 12 hr., during which the tung oil impregnation oxidizes. The pieces are then taken to an oven which is brought slowly up to 350 deg. F. temperature during a 2-hr. period and held at that level for 4 hr., during which the tung oil further oxidizes. Any "fry" which cakes on the outside of the casting is then sandblasted off and the piece is sent to a dichromate solution, which further cleans it.

This completes the operation, the casting then going to machining. After machining, the piece is further

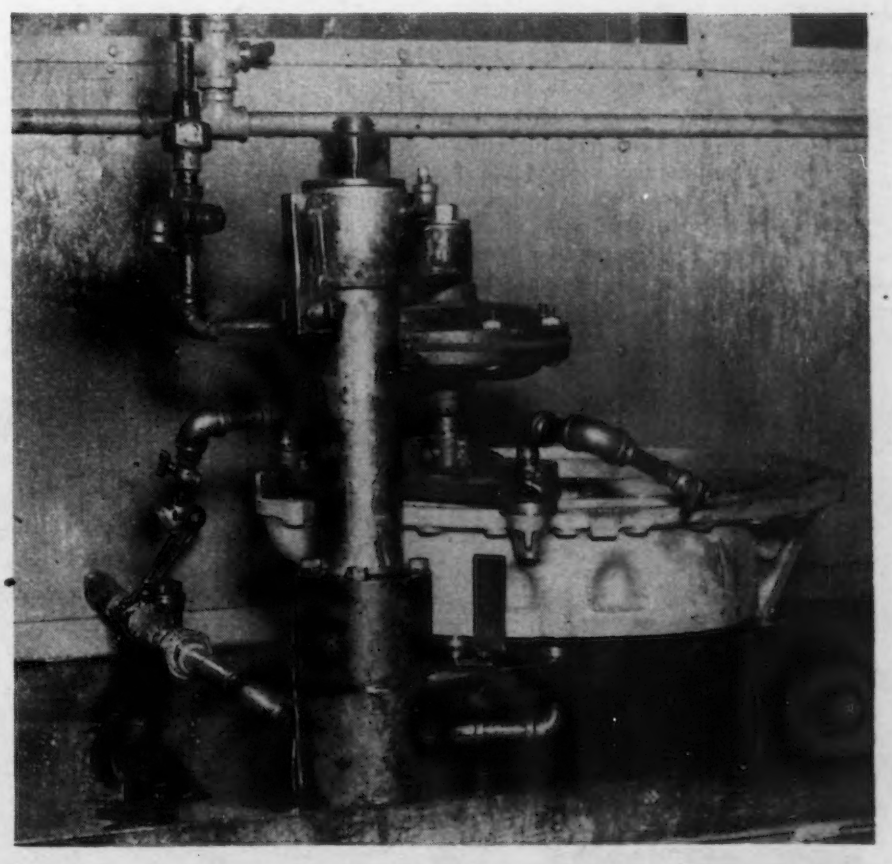

FIG. 1—Impregnation of a rear intermediate crankcase section is done in this fixture. Hydraulic pressure through the line running from the top clamps the piece into place. The valve running from the horizontal pipe at left is opened, and the crankcase filled with impregnating fluid which flows out through the line terminating at right. Once the passage has been filled, the valve at the end of the overflow line is closed, and the resulting pressure forces tung oil through any porosity which may exist in the casting.

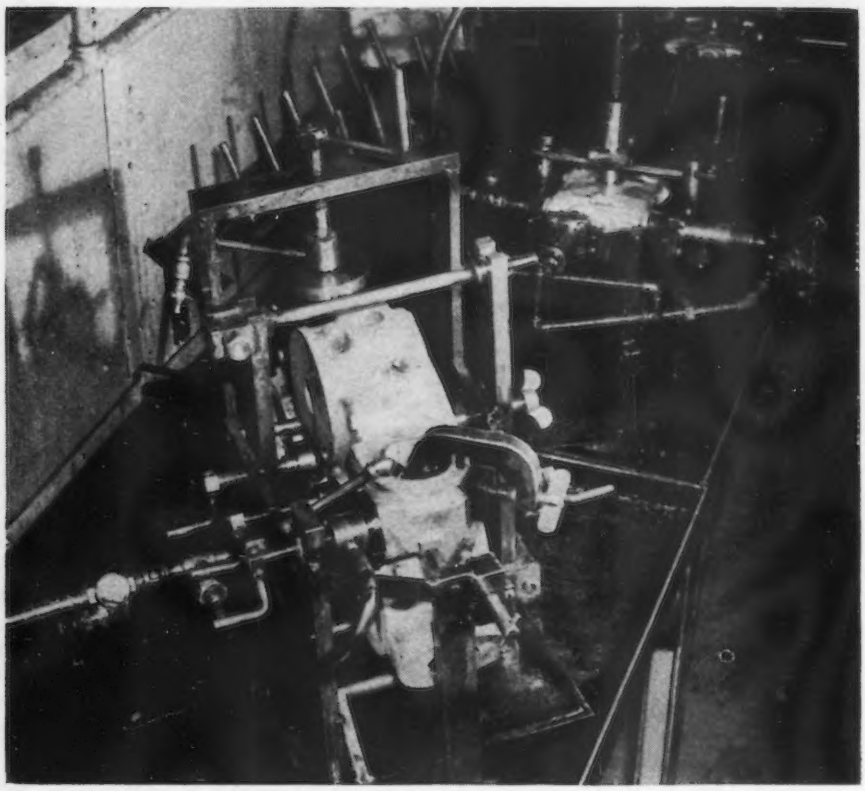

FIG. 2—This more complicated fixture impregnates a rear crankcase section. After being locked into place, the piece receives fluid from the pipe at left. Overflow valve can be seen emerging under the crossbar at the top of the fixture, ending in a valve from which overflow escapes onto the tray.

tested under 250-lb. pressure, a customary step under any system of impregnation. If porosity is then manifested, a second impregnation is usually attempted by the machine shop, either by the vacuum system which has prevailed generally up to now or by simple soaking in tung oil or silicate of soda. If porosity is still evident after this second impregnating attempt, the casting is scrapped.

The fixtures utilized at the Chevrolet Grey Iron Foundry are simply constructed. They are built primarily of pipe with the fittings made air tight by the use of old rubber belting cut into gaskets. Operation is hydraulic with the line under shop pressure clamping the pieces tightly into place. The entire set-up is so simple that the most complicated casting can be placed to receive the tung oil within 2 min. or so.

The impregnating department at Saginaw has nine fixtures, one for each type of casting now being produced. (See Figs. 1 and 2.) Three more fixtures of each type will be employed, now that the system has been proved and adopted.

This new method appears to provide noteworthy improvements over the old system where production runs are involved. Generally accepted methods of impregnation up to now revolve around one which was developed several years ago by Dow Chemical Co. This method has been to create a vacuum ranging all the way from 22 to 28 in., as the user sees fit, in an autoclave chamber in which a tray of castings has been placed. This exhausts air in pores of the casting. Tung oil is then flowed into this autoclave tank in sufficient quantity to cover the castings. Air pressure of 100 lb. or so is then introduced and held from 35 min. to 1 hr., depending on user's technique, as a means of forcing the tung oil into any porous areas. This basic method is being used today in many plants which have used up their supplies of tung oil and are leaning on substitutes like silicate of soda or others developed by individual companies.

In these orthodox autoclave methods, pieces are then removed to a kerosene rinse. They are next taken to a tank of hot engine oil electrically heated to 475 deg. F., where they remain for 45 min. to set the tung oil. Another kerosene bath follows to remove the engine oil residue and in this second bath, the tung oil is soaked off the casting exterior and interior. Decreasing operations follow, and then comes the bake at 350 deg. F. to oxidize the tung oil and to impede frying out.

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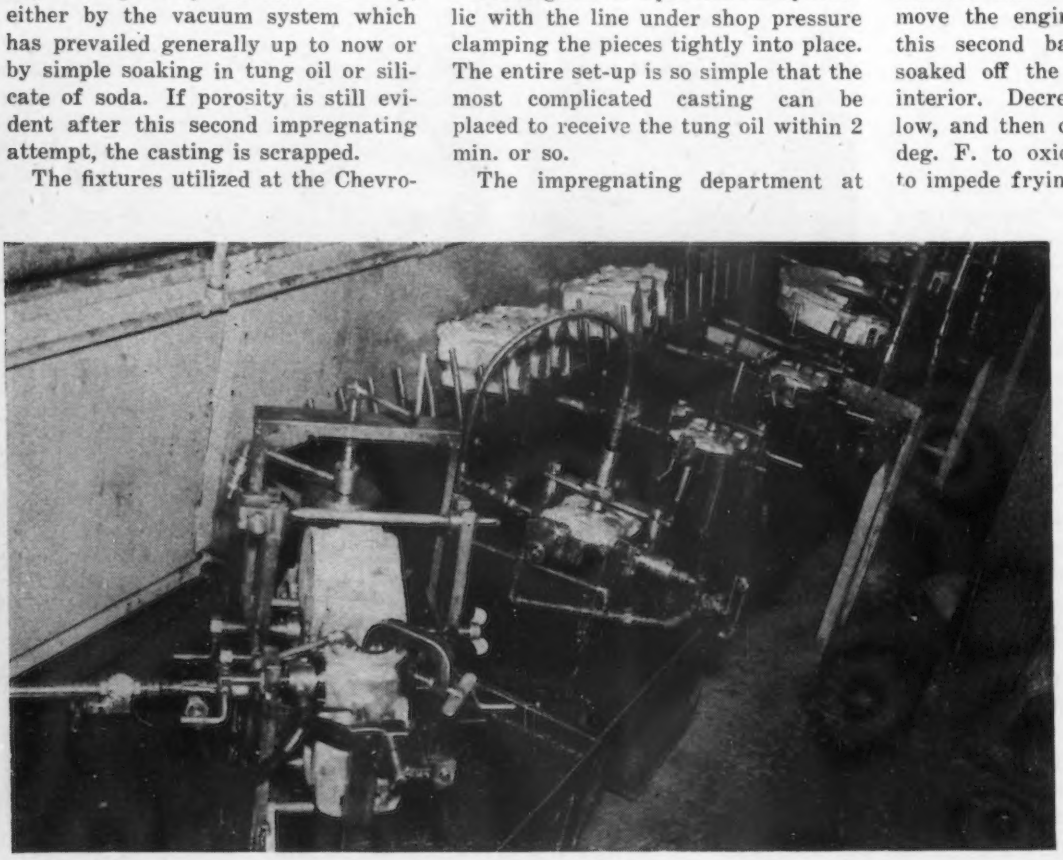

FIG. 3—This bird's-eye view of the magnesium casting impregnation department of Chevrolet Grey Iron Foundry Div. shows the small space required for the operation. Fixtures for each of the aircraft engine castings produced are arranged side by side on a long stand of trays. Impregnating fluid is fed into each fixture from a supply pipe located at rear on the tables; overflow runs into the trays and thence to a collection tank.

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The time cycle in this latter type of operation is obviously lengthy, but it still appears to be the most satisfactory means where a variety of pieces must be handled. Where shapes are uniform, as in a production shop, notable time savings are involved with the new Chevrolet technique.

The old method also uses up considerable quantities of tung oil which, since the semi-isolation of China, has been in consistently smaller supply. There is considerable loss in the cleaning operations which intersperse the major steps in the process. The new method evolved by Chevrolet utilizes comparatively little tung oil, inasmuch as any flow through the overflow valves drops on to a table and goes into recovery tanks.

Required factory space is importantly reduced also. As against the battery of tanks required for an orthodox impregnating system, the Saginaw layout provides merely a long narrow table (see Fig. 3) on which the fixtures are spaced out, all connected to a basic oil supply line which runs along the rear of the table. Degreasing and washing tanks are arranged against one other wall, along with the baking oven.

Although the new system has been operating only a short time, actual impregnation appears more satisfactory than in the older method. Positive soaking of the casting with the sealing tung oil is accomplished and is visually evident, and this has resulted up to now in a much greater proportion of castings passing the first impregnation test at 250-lb. pressure than ever before. Operations, however, are as yet limited, and completely confirmatory operating statistics likely will not be available for some time.

Hardenability of Low Carbon Steel

FOR some time the Swedish Jernkontoret has been sponsoring a comprehensive research on the hardenability of steel. That part of the research dealing with the variation in hardenability of an unalloyed steel containing 0.75 to 1 per cent C is described by S. von Hofsten in a recent number of *Jernkontorets Annaler*, and reported in *Iron and Coal Trades Review*. This author and his collaborators have examined the effect of P, S, Mn, V and Sn by the standard Jernkontoret fracture test applied to sharp-notched rods of 20 mm. diameter. In this test, fracture coefficients are evaluated, being the higher the finer grained the steel. At the same time the depth of the case and the sensitivity of the steels to hardening cracks was also investigated. The fracture was tested after hardening at six different temperatures, at intervals of 30 deg. from 770 to 920 deg. C. From the individual figures obtained at these temperatures the aggregate hardness coefficient for each steel was deduced.

Test pieces were prepared by pouring 50 to 60 kg. of metal from large melts into a small ladle, there to be alloyed with the elements required, and finally cast in a small mold. The ingots were then rolled down to 24 to 25 mm. diameter, turned to 22 mm., and finally polished. Before hardening in brine at 20 deg. the samples were usually heated in salt for 10 min.; in a few cases the samples were heated in an electric muffle after packing in iron turnings.

In the case of the P steels, a marked reduction was observed in the coefficients as the hardening temperature was raised; the reduction was small as the P was increased. The C was 0.99 per cent. At temperatures between 890 and 950 deg. the samples were hardened throughout. On the whole, the results of adding P indicate that there is a continuous and uniform reduction in the hardness coefficients, *i.e.*, a continuous coarsening of the grain, although the relationship is not always distinctive, sometimes the curves show a linear variation, and in other cases a curve is obtained with a sharp kink at the center. P appeared to have the greatest effect on the two steels made in the arc furnace, which differ by wide and narrow hardness ranges. But, consistently, the depth of hardness increased in proportion to the P, as also did the sensitivity towards the formation of hardness cracks.

The effect of S was studied on two steels made in the acid h.f. furnace, containing 0.74 to 0.77 and 1.01 to 1.03 per cent C, 0.21 to 0.33 per cent Si, 0.26 and 0.31 per cent Mn, 0.023 to 0.025 per cent P, and 0.011 to 0.092 per cent S. To one of the steels 0.1 per cent Al was added. The sulphur content appeared to cause a definite increase in the aggregate hardness numbers, the first additions already having a market effect. The depth of case increased with rising S, inclusions obviously acting as nuclei.

To study the effect of Mn, melts were also taken with and without Al. Four steels were examined, a 0.93 per cent steel made in the basic h.f. furnace, and three others with 0.5, 0.95 and 1.0 per cent C being made in the acid h.f. furnace.

The results confirmed previous knowledge that raising the Mn from 0.5 to 1 per cent reduces the hardness number, no further effect being observed with higher proportions. A further increase with 1.5 to 2 per cent Mn still appears problematic; in this range the Mn causes a marked coarsening of the grain, although this effect may be completely masked by the addition of Al. The differences found between the first three steels is ascribed to the higher Al concentration in the case of the first steel, although they may also be due to a different distribution in the nuclei. As already established, the depth of hardness is considerably raised by the addition of Mn, this effect being reduced by the addition of Al. According to this work, it is thus possible to obtain a deep-hardened steel with a fine fracture by raising the Mn and at the same time adding Al. Hitherto this result has been achieved mainly by adding small quantities of V. The tendency to form hardness cracks increased in proportion to the Mn added.

In the case of vanadium, some difference in the effects produced were observed, and were probably due to the different degrees of deoxidation of the steels investigated, the effect of small V additions being the greater the greater the deoxidation of the steel. An acid o.h. steel investigated appeared to occupy a middle position. The advantage of adding V is that it not only refines the fracture at ordinary hardening temperatures, but also maintains this fine fracture when the hardening temperature is raised. It appears that no effect is produced when the V is raised above 0.8 per cent. The addition of Al apparently intensifies the effect of adding V and thus enables the amount of V added to be reduced. The depth of hardness decreases as the V is raised. What effect the V had on the formation of hardness cracks could not be established, but it was confirmed that if the correct amount of V is added the hardness properties of an unalloyed steel could be altered within wide limits, and in particular the fracture refined and the hardness range increased. The investigators also report on the variation of carbide solution at different temperatures.

Tool and Operation Planning

IN the aircraft industry tool and operation planners have been a long suffering lot. They very carefully listed the operations for a certain job and ordered the tooling necessary to complete it. The tool designers would not agree and would proceed to design something altogether different, which was then turned over to the tool maker, who oftentimes would conclude it unsuitable, and go ahead according to his own ideas.

Finally completed and delivered to the shop, the tool would be given one glance by the day foreman who would then throw up his hands in disgust and go over in a corner to make a tool coinciding with his own ideas of the proper procedure. And of course the night foreman, who as a matter of principle could never agree with "those day shift men," would discard all other ideas and go into a different corner to emerge with still another version of the same tool.

Naturally the tool planners, tool designers and tool makers knew what was going on; they knew it didn't matter much what they did and their work suffered accordingly. Both day and night foremen found in this a perfect opportunity to prove their invincibility, and just so no one would ever forget it, would upon occasion **refrain** from building **their own** tools and establishing **their own** methods. The occasions must have been carefully selected, for the resulting confusion created such havoc that the planner, tool designer and tool maker packed their respective bags and went back to rabbit breeding or some other more satisfying occupation.

Foremen Made Into Tool Planners

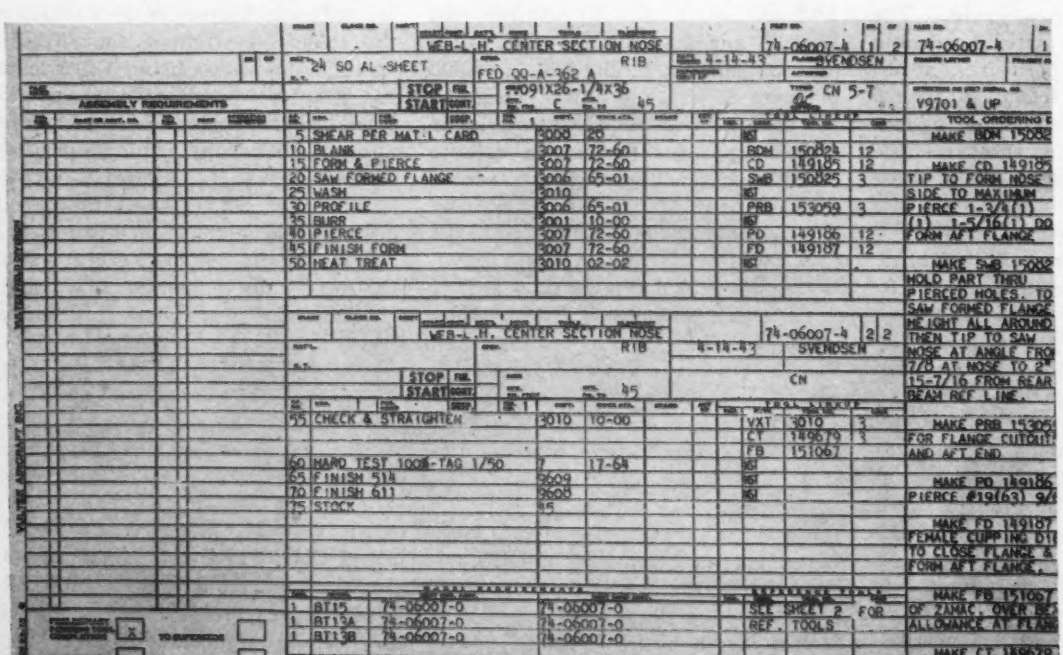
At Vultee Field we took the bull by the horns and decided that planning should mean what it said and that the tool designer, the tool maker and the foreman should do exactly what was specified—no more, no less.

Since the foremen were the worst offenders, we transferred them to tool planning; the original personnel had disgustfully gone their respective ways anyway. The scheme worked. As it is now set up, the aircraft tool and operations planner is supplied with blueprints of the complete airplane, its major assemblies and component parts, and is responsible for the issuance of detailed instructions for its manufacture.

These instructions, termed "planning" are supplied for each of the thousands of fabricated parts and for each assembly operation, beginning with the withdrawal of sheet metal, bar stock and other raw materials from the store rooms to the flying away of the finished airplane.

Every tool that is designed and put into use is in accordance with the planner's detailed description, and the movement of every truck and lot of materials, parts in process, finished parts and assemblies, from store rooms to machine, from machine to bench, from paint room to assembly line, is as directed by planning, which has now come into its own.

The engineering department specifies what to make and purchasing buys the material. Management provides the bank account and planning writes the checks for every tool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10 BLANK 3007 72-60 BDM 150823 12
15 FORM & PIERCE 3007 72-60 CD 149185 12 MAKE CD 149185
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FIG. 1—The planning sheet that orders tooling and establishes operation sequence and place.

In an Aircraft Plant

By W. E. BRAINARD
Supervisor, Tool and Operation Planning, Vultee Field Div., Consolidated Vultee Aircraft Corp.

. . . The system described in detail by the author achieves what every "planner" dreams about—complete control of operating sequences, from basic decisions on types of tooling to final assembly, with all the cost factors properly coordinated. This article was abstracted from a paper presented by Mr. Brainard before the Southern California Section of the Society of Automotive Engineers.

made and for every hour of labor to be performed in the production of aircraft.

Equal in importance to the function of planning new assemblies and new parts is the responsibility of changing planning. As manufacturing and flight experience is attained, engineering revisions are made necessary or advisable. Equipment changes, improved techniques and material substitutions for war shortage items all contribute to the requirement of continually changing tools and manufacturing procedures.

Planner's Function

The extent of this function is indicated by the thousands of changes that must be made each month in every major aircraft plant. The moving of a hole location in a single part may affect several tools required in its making, including the reference tools to which the manufacturing tools are built and the several jigs and fixtures involved in succeeding subassemblies and assemblies.

The planner must be on the alert and capable of making certain that all affected tools are reworked. He must be capable of exercising considerable ingenuity in utilizing existing tooling with a minimum of rework or in the making of new tooling.

He must have a good working knowledge of the costs of making or reworking tools, and of the costs of manufacturing operations in order to arrive at the most economical solution. He must have a knowledge of prevailing machine loading in both manufacturing and tool making departments in order to make certain the new routing can be accomplished, and that the necessary tool work can be accomplished in time to meet the date upon which the change is scheduled to be effective.

When planning a new airplane, a number of precepts must be established to serve as a general guide. It must be determined whether the proposed schedule can be met by a single tooling program, or if it will be necessary to provide an additional set of simple tooling for initial production. Such a determination is made by the use of approximate tool cost factors based upon past experience. Thus, total tooling hours required may be compared with daily tooling hours available, and the fairly accurate tool completion schedule thus derived may be compared to the initial production schedule of the proposed airplane.

General Assembly Plan

Also, a general assembly plan must be decided upon. Consolidated Vultee pioneered the use of powered conveyor assembly lines for aircraft. Their universal adoption by other manufacturers, together with our own cost records, has proved their value.

At current rates of production the problem is not one of deciding whether conveyor lines shall be used but rather one of determining the extent of application. The final assembly of the airplane, for example, is definitely a conveyor job. Many of the major assemblies, such as inner wing, outer wing, fuselage and power plant are also adaptable to conveyor line assembly, arranged to feed in to

FIG. 2—The first tool is the mock-up—plaster faired between sectional metal templates. It is used as a reference tool for all contours.

the main line at the proper attaching stations.

Consideration should be given to the type of operations required to create the assembly. Parts fastened by bolts and screws, for instance, are usually interchangeable for field replacement reasons, and therefore must have all holes full size in the detail parts or minor assemblies. As a result the assembly operation is simply that of adding the part and securing it to the assembly. On the other hand, parts that are added by riveting are not so well adapted to conveyor line assembly, although small brackets and similar parts may be successfully handled providing all attaching holes are coordinated in the detail parts.

Spotweld assembly methods to date have attained no consideration in conveyor assembly. Some success has been attained in the arc welding of small brackets and supports to a conveyor-moved fuselage, although the structure itself is assembled in the jig.

The logical procedure is to list the parts that may be conveniently added to an assembly traveling on a conveyor. Time standards for typical operations should be established and refererd to in order to establish manloading. Typical conveyor installation costs can be applied and a sufficiently accurate analysis prepared.

As production requirements skyrocketed, it became economically sound to break the assembly down to a number of small subassemblies, bringing them together in mating jigs. It also became possible to restrict the actual work done in the jig to drilling only. The parts can then be removed and riveted together on the bench or on wood stands without special tooling. This increased the work output per jig, and resulted in better accessibility while riveting.

FIG. 3—A typical master tool which permanently establishes hole locations in units of an assembly. (See also Figs. 4, 5 and 6.)

When to Drill

One of the principal factors establishing the number of subassemblies involved, and what their part groupings will be, is the method of attaining the necessary rivet holes. To attain maximum strength, it is essential that very little clearance prevail between the rivet and the hole; thus hole patterns for mating parts must match exactly, as otherwise the rivet cannot be inserted.

Matching hole patterns for mating parts may be established by:

1. Drilling or piercing through both parts simultaneously while they are clamped in position.
2. Drilling or piercing each part separately and relying upon coordination of hole patterns.

An analysis of the various methods, based upon operation labor hours only, will show an approximate comparative ratio as follows:

Automatic Rivet—1 hr. per 1000 rivets

Drill and rivet in assembly—2 hr. per 1000 rivets

Drill in detail and rivet in assembly —2½ hr. per 1000 rivets.

Automatic riveting requires a simple work holding fixture which preferably should provide an indexing

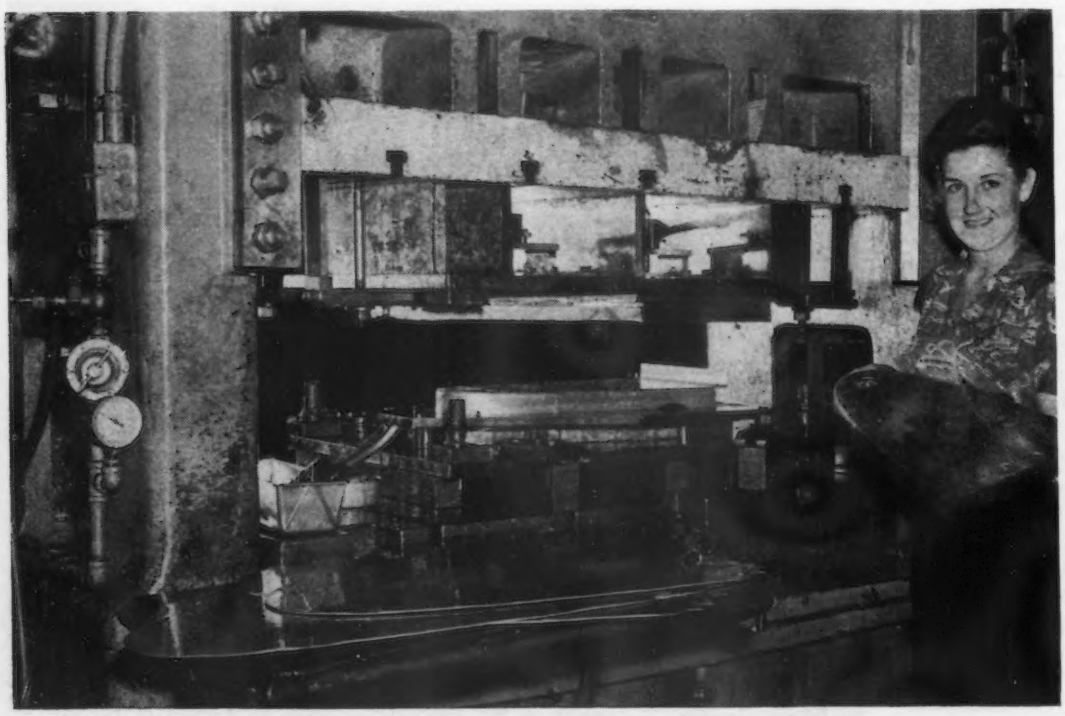

FIG. 4 — Considerable time is saved and proper hole coordination assured by piercing while forming (as shown) or blanking.

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plate for quick and accurate rivet location. The process is applicable only to flat or nearly flat assemblies and is limited to a total metal thickness that does not exceed the rivet diameter. The process should be favored wherever it can be used, as it is approximately twice as fast as the next best method.

Drill and rivet on assembly will take approximately 2 hr. whether drill bushings are used and both parts are drilled through together, or if undersized holes are used as pilots in one part to locate the hole pattern and jig bushings are not provided. If it should be necessary to obtain the pilot holes in the one part by drilling, at least ½ hr. would be added to the total time for 1000 holes. However, if the pilots can be obtained by piercing while blanking, no increase in operation time occurs, and we have simply traded additional punch press tool making time for a reduction in assembly jig making time.

If both hole patterns can be obtained during detail part fabrication without additional operation time, the time would drop to about 1½ hr. per 1000 holes. Here, the point to be considered is that of coordinating the two hole patterns. If the holes are outside the metal distortion area of subsequent forming or would not be affected by quench distortion following heat treat, there should be no particular trouble.

Use of Pilot Holes

Still another solution is that of providing undersize pilot holes in the first part coordinated to a few pilot holes in the second part. Clecos or similar clamping devices are inserted in the coordinated holes, and the remaining holes are then drilled and riveted. The clecos are removed, their holes drilled full size and the remaining rivets are set. This method will add slightly to the 2½ hr. comparative figure, if all holes are drilled, but the procedure simplifies jig construction, eliminates drill bushings or drill plate and locating pads. In fact, many small assemblies may be made on the bench, eliminating assembly jigs entirely.

Other subassembly groupings will depend upon design arrangement and upon how the holes for rivets are to be attained. Following a tentative breakdown, the planner prepares a detailed planning for each assembly. He establishes the list of parts to be assembled, and the order in which they are to be installed in the jig. He then writes the tool order for the jig, specifying the method of location for each part. It is also necessary to specify the master or reference tools required by the tool maker, and to order them. These will include plaster mockups of contours, templates, and master tools for coordinated hole patterns and duplicate tooling. The planner should establish an approximate manhour-per-jig time requirement, basing duplicate tool ordering or additional assembly breakdown upon this amount.

In discussing assembly operations, two new and rather interesting procedures developed at the Vultee Field Division. The first pertains to air ducts of aluminum sheet metal. The parts are drop hammer formed, with coordinated pilot holes for tack rivets being drilled and trim lines scribed in a small simple jig. The jig consists of a wooden nest for the part, and a hinged press template which clamps against the nested part.

The parts are next trimmed to size, clecoed, spotwelded, tack riveted and finally heat treated as an assembly. The quenching strains following heat treat have little distorting effect on the assembly, as it is quite rigid. Straightening operations otherwise

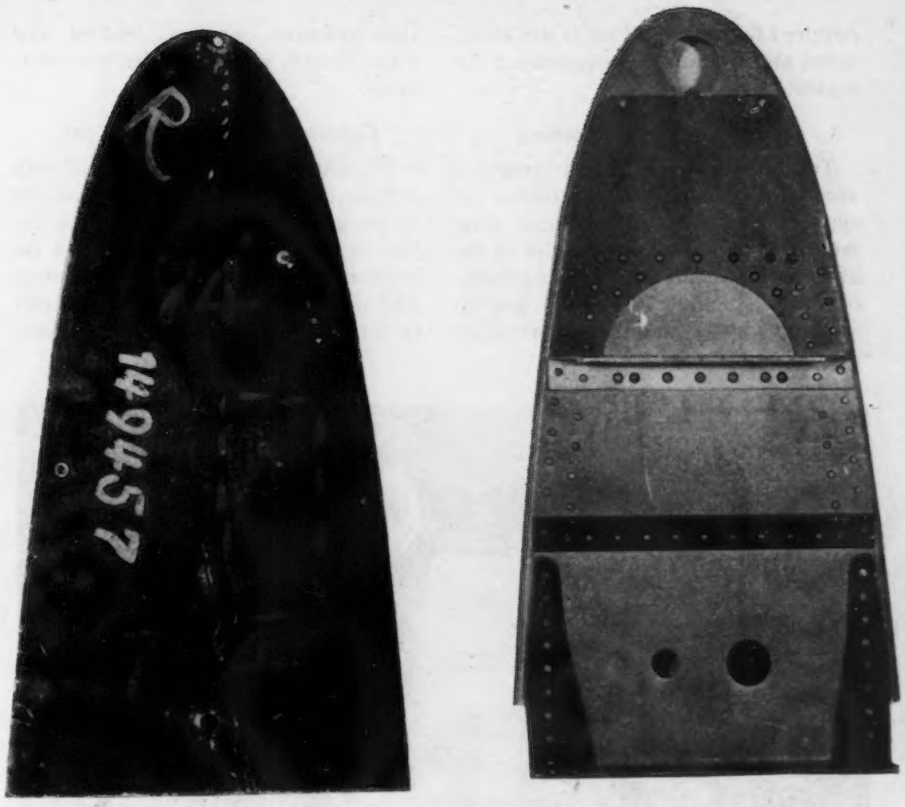

Fig. 5—The finished rib assembly and the template that established its contour.

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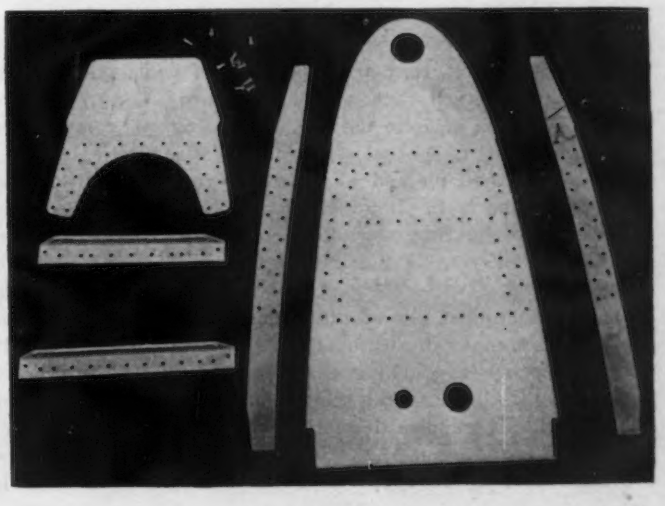

FIG. 6—All mating parts are brought together. Tools that create hole patterns of each detail part were coordinated by means of the tooling master shown in Fig. 3.

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required for the detail parts are eliminated and there is no requirement for assembly tooling.

Example of Spot Welding

The second development concerns spotweld assemblies of corrosion resistant steel, such as the inner ring, muff and diaphragm assemblies of the average power plant. Following forming and trimming, the parts are installed in a jig and tack spotwelded, using a portable gun or yoke. They are then finish spotwelded at a standard machine. Next, they are installed in a jig and pierced with a squeezer yoke using index holes in the jig, similar to bushings. Large holes and hole patterns are then pierced at a large pneumatic yoke from pilots. The tooling is simple, jig time very low, and a minimum of trouble has been experienced.

Detail planning is one of the major jobs of the planner in aircraft plants. To give a practical working example, we might use sheet metal aluminum alloy parts. The choice of method is principally based upon cost. However, available tooling time, possible design changes, machine loading and other factors warrant major consideration.

Determining Rejection Costs

The planner should be provided with sufficient data to enable a reasonably accurate forecast of tool cost, operation cost, material scrap cost and rejection probability. Probable rejection cost is the item that is most difficult to determine, either in terms of man-hours and material lost or in terms of dollars. This is because of the lack of sufficiently detailed experience records. The cost determination is rather that of comparison of methods and upon critical analysis of those particular conditions that may arise due to peculiarities of product or process.

First operation usually performed in fabricating a detail sheet metal part is that of shearing. To keep scrap down, the planner arranges the most economical layout and determines the size of sheet to be issued from the stock room. High production blanking may be accomplished very successfully with punch press, shearing with rubber in the hydropress, stack routing, circle shearing and square shearing. The proper method is easily chosen by the planner armed with adequate cost data on tooling, operation time and scrap generation. Incidentally, many blanks developed for drop hammer and punch press forming can be attained by shearing instead of the more expensive operation of routing, as rounded corners are often unnecessary.

The best method for forming, bending or drawing is not so easily arrived at. Here, accuracy requirements, heat treat distortion and other factors usually isolate the problem to one or two methods that will produce acceptable parts. Here again, proper cost information will allow a selection of the preferable tooling.

Fig. 7—The rib becomes part of a wing nose section and supports the landing gear.

Control of Scrap

The importance of scrap consideration in planning may be emphasized by a typical example, that of a corrosion resistant steel segment used in an engine exhaust collector ring. Based upon 5000 parts, a drop hammer formed part generated a scrap loss amounting to three times the tool and production labor. It was found that because of scrap loss the more expensive tooling for the mechanical press would justify its selection for a minimum of 700 parts. In spite of this condition, most collector ring parts in this country's aircraft plants are drop hammer formed. Competent planning can eliminate much of this waste and expense.

At Vultee Field planning has been divided into four functions. First, there is assembly planning, with a group assigned to each project and their job is just what the name implies. Second, there is a detail planning group for each manufacturing department, which includes machine shop, sheet metal, and electrical. Third, there is process planning which includes the determination of how, when, and where to wash, clean, plate and paint parts. This division specifies magnetic inspection and hardness test operations and other jobs of a similar nature. Finally, there is the clerical division which handles the detail office work.

As the job advances through the planning department, until the master order goes to the production department, return vouchers to the dispatcher provides a posting of all progress. This allows a daily determination of loading on all groups, and eliminates bottlenecks by allowing some personnel transfers in order to keep all groups approximately equal in work.

Machining and Forming 14ST Aluminum Alloy

. . . Shortage of aluminum extrusion capacity, noted early in 1943, was attacked from several angles so successfully that there actually resulted an oversupply of extruding capacity in the 4th quarter of 1943. It is understood that several hammer installations planned early in the year are being abandoned. Vigorous industry cooperation in the substitution of rolled sections was one approach. The other was the use of 14ST alloy in place of 24ST since the former can be extruded approximately 26 per cent faster. Because of difficulties first met in machining and forming 14ST alloy, a special committee of the Aircraft War Production Council, Inc., Los Angeles, undertook tests to establish new procedures. Reports of these tests and the conclusions drawn therefrom are summarized in this article.

WHEN machining aluminum of any alloy, a thorough knowledge of the fiber stresses should first be obtained wherever possible. The main precaution in machining either 24ST or 14ST, according to Douglas engineers,[1] is to anticipate the warpage that occurs when the fiber stress in the hot rolled or extruded shape is relieved when the cross-section is reduced by machining. Tests made on hot rolled 14ST or extruded 24ST of 20.26 sq. in. cross-section indicated that there was an average shrinkage of 0.001 in. per lineal inch when deep body cuts are made. In either hot rolling or extrusion, due to unequal rates of cooling, the fibers in the middle of the cross-section are left under tension and the outer fibers are under compression since they cool first. When these stresses are relieved by machining, the piece both shrinks and warps. The greater the cross-section, the greater the differential between the compression and tension fibers and the greater the warpage and shrinkage.

[1] *"Treatise on Machining, Bending, Straightening Aluminum Alloys," prepared by G. R. Gwynne, project supervisor, machine tool processing, Douglas Aircraft Co., Santa Monica.*

Douglas was able to compute the amount of warpage to be expected by splitting 14ST hot rolled billets 5⅝ in. sq. with corners leveled 45 deg., 1 in. on the diagonal. It is interesting to note that attempts to split the billet with a band saw were unsuccessful. Using a three point saw, 0.035 in. thick, operating at 5177 lineal ft. per min., the billet failed from internal stress after being sawed for 12 in. and the failure continued in an even pattern every 12 in. of cut. Fracture of the metal was from the sharp corner in the cut to the outside surfaces in a compound hyperbolic curve and was definitely a fiber stress failure, referred to by Douglas engineers as a "Tulip" fracture.

It was found, however, that if a slot ¼ in. wide and 1 in. deep were first milled on opposite sides, splitting of the billet by band sawing could be accomplished without the stress failure mentioned above being encountered. In both milling and sawing a flood of coolant was used, the mix being 80:1. Warpage data on 48 in. billets on several alloys are recorded as follows:

Alloy	Warpage in 48 In.	Force Req'd. To Straighten Lb.
14 ST	0.238-0.250	28,000
24 ST	0.235-0.253	20,000
14 SW	0.240-0.254	18,000
14 ST	0.229-0.242	22,000

The average bow is ± 0.006 in. per in. of split for a cross-sectional area of 15.82 sq. in. per side. This factor will vary with increase or decrease in the cross-sectional area.

Another factor influencing this warpage is the fiber structure within the formed billets themselves, whether they are hot rolled or extruded. The tests described above were made on billets that were scalped all over. By contrast, in one hot rolled billet of an irregular outside contour that was not scalped, the actual warpage obtained after splitting was as high as 0.0223 in. per lineal inch. Results of tests made on extrusions were not much different than on hot rolled billets.

Milling Cutter Design

After some experimentation with cutters, Douglas evolved the designs specified in Table I, all of which

proved to be successful in production. In every type the cutting edges were tungsten carbide. All grades of the hard carbides were found to work equally well. In fact, every participating company indicated that carbide tipped tools are required because of the high speeds necessary for machining the 14ST alloy.

See also "High Speed Milling," THE IRON AGE, Oct. 14, 1943, in which a large number of milling tests on both aluminum and steel alloys were tabulated.

On the large spar cap mills, the total power input ranges from 140 to 160 hp. and in more than one operation cuts are being made with four cutters siamesed to two spindles and the momentary overload of the motors is 50 per cent. In these cases actual metal removal is at the rate of 3½ cu. in. per hp. per min. On the horizontal milling saws, on the other hand, with a feed of 60 in. per min., 425 cu. in. of metal is removed in 5½ min. with a total power input (5 spindles) of 37½ hp., or 1.10 cu. in. per hp. per min. of metal removal. The reason for this low factor is the rate of cutter travel into the work, which will be speeded up as experience develops. The foregoing figures hold true on either 24ST extrusions, 14ST hot rolled billets or 14ST extrusions.

Vega Machining Tests

Tests made on the milling of 14ST extrusions at Vega[2], led to recommendations of peripheral speeds of 8000 to 15,000 ft. per min., using tungsten carbide tipped cutters and tooth loads not lighter than 0.004 in. chip thickness per tooth. Table II summarizes data from which these conclusions were reached. These tests were made on a hy-cycle milling machine. It will be noted that with 150 in. per min. feed, stepping up the spindle speed from 8000 to 9000 r.p.m. results in a poor finish becoming worse as the tooth load progressively declines at 9000 r.p.m.; however, when the feed is stepped up to 225 in. per min. (resulting in the same tooth load as at 6000 r.p.m. with 150 in. per min. feed) the finish obtained was excellent.

[2]"Machinability and Formability of 14ST Extrusions," prepared by Homer Brown, tool development section, Vega Aircraft Corp., Burbank.

Similar tests on slitting saws showed similar effects. A Kennametal tipped saw of 6 in. diameter, operated at 9000 r.p.m. (14,137 f.p.m.) and 225 in. feed (0.0031 in. per tooth) gave a good finish and no signs of wear were noted on the cutting edges after 125 cuts. An 8 in. saw tipped with the same material (Kennametal K4H) showed definite signs of wear after 60 cuts and produced only a fair finish. This was because at 9000 r.p.m. (18,850 f.p.m.) and 225 in. feed, the feed per tooth was only 0.0025 in. Incidentally, Vega engineers concluded that any improvement made in the machining of 14ST would show corresponding improvements in machining 24ST.

Router Tests

Routing tests made at Vega indicated that a one-flute router bit is much to be preferred over a two-fluted bit. Nine pieces 60 in. long and ⅛ in. thick were cut on an Onsrud radial router with a 5-hp. motor operating at 15,000 r.p.m. nominal speed. Two cuts were made on each test piece. With the two-flute cutter, the material blistered up on the edge of both flutes at the end of the fourth cut on one test and at the end of the sixth cut on a second test (opposite end of router bit used). With the single flute bit, on the other hand, no apparent dulling of the router bit edge nor any blistering of metal on the edge were noted at the end of eight cuts.

Further Vega tests showed that 14ST is definitely more difficult to saw with a radial circle saw than is 24ST. The following saws were used in the test:

	High Speed Steel	Stellite
Diameter, in.	14	14
No. of teeth	76	96
Width, in.	⅛	⅛
R.p.m.	2825	2825
Hp. of motor	7½	7½

Comparative cuts made before definite dulling was observed were as follows:

TABLE I

Carbide Tipped Cutter Data for Milling 14ST

Cutter Specifications	Horizontal Spar Cap Mill	Vertical End Mill	Horizontal Splitting Saw
Diameter, in.	8	1¼	9
Width, in.	1-2	1½-2	3/16, 7/32, ¼
No. of blades per cutter	4	2	6
Helix angle, deg.	10	Negative	Negative
Front rake angle, deg.	5	5	7
Primary clearance, deg.	5	5	5
Land width, in.	1/32	1/32	1/32
Secondary rake angle, deg.	15	15	12
Side clearance angle, deg.	..	..	2
Spindle speed, r.p.m.	3000	14,800	3000
Peripheral speed, f.p.m.	6283	4,843	6819

TABLE II

Hy-cycle Milling Tests Made to Determine Optimum Peripheral Speed

Spindle Speed R.P.M.	Peripheral Speeds Ft. Per Min.	Feed in Inches Per Min.	Tooth Load In./Tooth	No. of Cuts Made	Remarks
6000	9,426	72	0.002	5	Finish fair
6000	9,426	150	0.0041	5	Finish very good
6000	9,426	225	0.0062	0	Inadequate power
7000	10,995	150	0.0035	7	Finish fair
7500	11,781	150	0.0033	5	Finish fair
8000	12,566	150	0.0031	5	Finish poor
8500	13,352	150	0.0029	5	Finish very poor
9000	14,137	150	0.0027	5	Finish very poor
9000	14,137	225	0.0041	250	Finish excellent

Cutter Specifications							
Diam. In.	No. of Teeth	Helix Angle Deg.	Clearance Angles Prim. Deg.	Clearance Angles Sec. Deg.	Rake Angle Deg.	Tip Size In.	Tip Grade
6	8	+10	7	12	+7	3/16 x ⅜ x ½*	Firthite HA

*No radius or chamfer on corner of tip was used.

Material	H.S.S. Saw	Stellite Saw
14 ST	18 cuts	24 cuts
24 ST	130 "	180 "

As has been indicated earlier in this summary, on the other hand, 9 in. diameter milling saws, 3/16 to ¼ in. wide, with six blades of tungsten carbide proved very satisfactory, according to Douglas tests. It should be pointed out, however, that the splitting saws have power feed, while the radial circle saws tested by Vega have hand feed, which is difficult to control.

Drilling

Comparative drilling tests made on 14ST and 24ST at Vega were rather inconclusive. After experimenting to determine correct speed and feed for the material, the following life data were obtained:

Drill Size	Speed R.p.m.	Feed In./Rev.	Material	No. of Holes*
5/16	2300	0.010	14ST	36
5/16	2300	0.010	24ST	91
No. 30	4700	0.010	14ST	205
No. 30	4700	0.013	24ST	139

* Drilling was stopped in each test at the first indication of increased feed pressure.

All drilling was done on hand-operated machines, the feed rate being maintained by stopwatch. A 40:1 solution of soluble oil was used as a coolant.

Forming

Bending operations on 14ST have presented a real problem and have caused the highest mortality in piece parts lost from shear breaks or vertical web to body cracks. Douglas[1] has found that pre-heating of the parts is necessary and must be so controlled that proper heat penetration is assured and the cooling effect of the dies offset. In bending a hot rolled 14ST spar cap of 20.26 sq. in. cross-section, for example, it was found that failure took place because too short a heating time was used.

Use of thermocouples in drilled holes indicated that the core temperature was only 260 deg. F. when the spar cap was heated for 1 hr. in a gas fired convection oven at 350 deg. F. Heating the spar cap sections for 2 hr. resulted in a core temperature of 320 deg. However, the heat loss which occurred due to the part coming into contact with the cold bending dies and the length of time of mounting dropped the core temperature below 300 deg. As a result, Douglas is now heating these spar caps up to 375 deg. and also heating the bending dies at the same time. The handling and bending time outside the oven has been reduced to 4 min. The core temperature at the end of the operation is now 310 deg. and the skin surface temperature, 290 deg., which is on the safe side. It is pointed out that care should be exercised to eliminate all shear lines or changes in cross-section area in the zone of the bend since several initial failures occurred from these causes.

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VEGA method of clamping spar extrusion to bedplate of milling machine. On this typical operation, cut runs out on both sides and bottom at a point 84 in. from each end.

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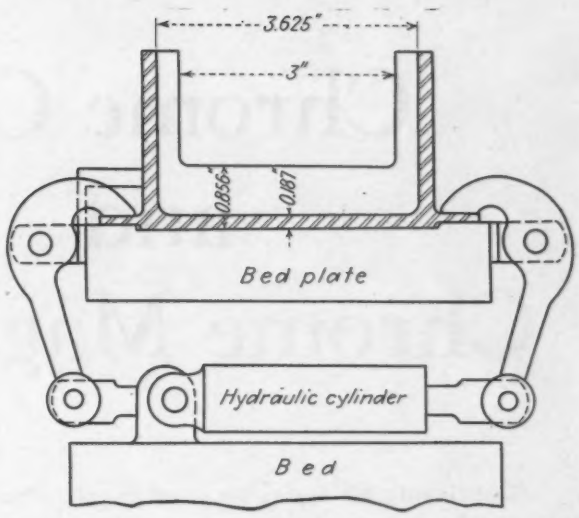

Due to warpage of outlines, straightening has caused considerable difficulty, particularly as to buckling the vertical mold line web and cracking in the radius at the body joint. By cut and try methods, Douglas determined that heating to a temperature of 125 deg. F. eliminates all failures on the straightening operation on the finished piece. While the parts were originally heated in a convection oven, installation of hot water tanks for this purpose is being arranged.

The above data applies to both hot rolled shapes and extrusions.

On one bend test[3] Vega successfully bent cold to 16 deg. 14ST channel spar caps 4 in. wide and 2½ in. high. The elongation at the base of the beam was 2.5 per cent as compared with an elongation of 3.5 per cent on a 24ST beam of the same section.

Tests[4] made at North American Aviation Corp., indicate that 14ST angles with ⅛ in. leg thickness can be joggled safely with a 1:3 ratio of depth to length of joggle: 14SW, with a ratio of 1:2½. For 3/16 in. material the corresponding ratios are 1:3½ and 1:3 for the 14ST and 14SW material respectively.

Degreeing tests indicate the followings as safe design values for this alloy:

Material	14ST		14SW	
Thickness in.	⅛	3/16	⅛	3/16
Degree opening of angle	3	3	4	4

Minimum bend radii indicated by tests are 3 t for either ⅛ or 3/16 in. plate of 14ST alloy and 2.5t for the 14SW alloy, where t is the thickness.

In forming, it is pointed out in another Douglas report[5], that 14S material is harder and has less elongation than 24S. There is greater springback in 14S material and the cross grain characteristics require that extreme care be exercised in opening and closing angles in 14S material. It is important that cross grain forming be held to a minimum and when found necessary it should be accomplished in very gradual stages. In joggling, the greater springback of 14S calls for a smoothing of the radii of the joggling blocks to eliminate the possibility of notching the material and an adjustment of the setting of the punch press in which this work is usually carried on. Similarly, form blocks used in contouring will have a radius somewhat less than for 24S to allow for the greater springback.

[3] *"Machinability and Formability of 14ST Extrusions," prepared by Homer Brown, tool development section, Vega Aircraft Corp., Burbank.*

[4] *"Summary of 14S Extrusion Conversions and Forming Tests," prepared by L. P. Spalding, North American Aviation Corp.*

[5] *"Forming and Machining Characteristics of 14S Extrusions," prepared by W. T. Leonard, Douglas Aircraft Co.*

Chrome Ore and Chrome Magnesite

By J. H. CHESTERS

Central Research Department, United Steel Companies, Ltd., Stocksbridge, England

. . . Continuing his series on steel plant refractories, the author in this, the first part of a two-part article, investigates the distribution, properties, condition and preparation of chrome ore, a product which has assumed a highly important position in economic warfare.

THE greatly increased use of alloy steels containing chromium, together with the fairly general replacement of magnesite brick in basic open hearth and arc furnace sidewalls by chrome-magnesite brick of higher thermal shock resistance, gives to chrome ore an important position in the field of economic warfare.

It can be seen from Table I, which lists the principal productions of chrome ore in 1938, that the supplies available to the United Nations have varied considerably since the war began and doubtless will again.

The only large consumer of chrome ore that does not require to import the bulk of its supplies, is Russia.

During the last war, there was a considerable increase in the amount of chrome ore mined, both in the United States and in Canada, and the loss of chrome producing countries during the present war has had a similar effect. Of the American deposits, those in California, Montana and Oregon are now being worked.

It is fortunate that many chrome ores that are unsuitable for the production of ferrochrome or for use by the chemical industry, are satisfactory for refractories. As a result, chrome ore shipments can be tested on arrival and their use determined by the properties they are found to possess, in particular their contents of iron oxide, chrome oxide and silica, and their behavior on grinding.

The fairly detailed account given here of the use of chrome in the production of brick and cements, will be limited to those aspects which are of ultimate importance to the steel plant.

Several references in the literature imply that chrome ore is either ferrous chromite ($FeO.Cr_2O_3$) or the sesquioxide (Cr_2O_3). In fact, ferrous chromite is found only in meteorites, while chrome ore frequently contains only about 30 per cent of Cr_2O_3. All the chrome ores examined consist essentially of a complex mixture of spinels in solid solution. The term "spinel" usually refers either to the general class having the formula $RO.R_2O_3$ and crystallizing as isotropic octahedra, or to the mineral $MgO.Al_2O_3$. The latter is known to many people, in its very pure and transparent form, as a gem stone. Magnetite, $FeO.Fe_2O_3$, which is well known to the steel plant operator as mill scale, is also a member of this family. Most crystals of chrome ore show rather imperfect development. Greater crystallinity is shown by other spinels, particularly when made by electrical fusion. Thus Fig. 1 shows a sample of magnesium aluminate made by this process. It has a triangular structure, which is one of the characteristic forms of spinel, and which is also shown, occasionally, by chromite. Thus Fig. 2 shows this type of cleavage structure in a thin section of chrome ore.

Previous articles by J. H. Chesters, on steel plant refractories, that have appeared in The Iron Age are:

"All-Basic Open Hearth Furnaces," Aug. 15 and 22, 1940.
"Steel Plant Refractories," Feb. 6 and 13, 1941.
"Basic Open Hearth Above Sill Plate Level," May 22 and 29, 1941.
"Basic Openhearth," Aug. 7, 14 and 21, 1941.
"Casting Pit Refractories," Nov. 20 and 27, 1941.
"Electric Steel Plant Refactories," March 5 and 12, 1942.
"Acid Open - Hearth Refractories," May 28 and June 4, 1942.
"Soaking Pit and Reheating Furnace Refractories," July 16 and 23, 1942.
"Acid and Basic Bessemer Refractories," Nov. 5 and 12, 1942.
"Silica and Semi-Silica Refractories," Jan. 21 and 28, 1943.
"Magnesite Refractories," June 3 and 10, 1943.
"Dolomite Refractories," Aug. 5 and 19, 1943.

The Spinels

By far the simplest method of identifying a mineral as a spinel is to take an X-ray photograph. The pattern is relatively simple and differs from one spinel to another only in the lattice size, and hence in the displacement of the lines. Certain compounds, having the type $RO.R_2O_3$, crystallize in other systems, as, for example, calcium chromite, which forms needles showing marked pleochroism. The lattice dimensions of a number of synthetic spinels were worked out by Parmelee, Badger and Ballam, and their data are given in Fig. 3. It will be seen that the lattice of the chromite spinels is intermediate between that of the aluminates and ferrites. Since, however, natural chromite is a solid solution, it will have intermediate lattice dimensions. Thus it can be considered in certain cases, for instance, Cuban ore, to be a solid solution of approximately equal amounts of magnesium aluminate and ferrous chromite. Since, however, a spinel may also contain part of its iron oxide on the R_2O_3 side, the lattice

dimension does not yield any definite evidence as to its constitution.

The investigators mentioned above, and more recently Hugill and Green, have done a great deal of work on the preparation and properties of synthetic spinels. Certain of these, for example, magnesium aluminate, are very easily prepared, but others like ferrous chromite, are very difficult to make because of the tendency of the FeO to oxidite. Thus considerable difficulty has been experienced in the production of both ferrous chromite and ferrous aluminate. The production of solid solutions of known composition is even more difficult, but minerals having essentially similar characteristics to natural chromite have been prepared.

The properties of spinels have recently been summarized by Hugill and Green, and it is of interest to note (Table II) that $MgO.Al_2O_3$ is colorless, while $FeO.Cr_2O_3$ is deep red. Since the powder density of the latter mineral is much higher than that of the former, it would be expected that chromites high in Cr_2O_3 would also have a high powder density. Similar considerations apply to the refractive index. It is also interesting to note that some chrome ores are quite strongly magnetic even before firing. This is generally attributed to the presence of magnetite, but could also be due to magnesio-ferrite.

The optical properties of spinels have recently been the subject of a paper by Winchell. A square diagram has been prepared with $FeO.Cr_2O_3$ and $MgO.Al_2O_3$ on opposite corners showing the variations in refractive index and specific gravity with composition.

Binary Systems

The $MgO.Al_2O_3$ system is shown in Fig. 4, from which it will be seen that the lowest melting point composition corresponds to an addition of approximately 2 per cent of magnesia to alumina (3497 deg. F.) and that the spinel composition itself melts at 3875 deg. The formation of spinel from equimolecular amounts of magnesia and alumina has been shown by Chesters and Parmelee to occur with a considerable increase in volume. This property has been employed in the production of steel-tight induction furnace linings. It is not necessary for this purpose to use the oxides in molecular preparations, adequate expansion being obtained even with a considerable excess of magnesia present. The reaction is much accelerated by the presence of mineralizers such as boric acid.

Melting point data for $MgO.Cr_2O_3$, reported by Wartenburg and Prophet, show that any addition of magnesia to chrome oxide raises its melting point, which for the pure material is approximately 4175 deg. F.

With regard to $FeO.Al_2O_3$, MacIntosh, Rait and Hay have shown that when alumina is added to ferrous oxide, the melting point drops quickly to about 2375 deg. F. for a 5 per cent addition, and then rises steadily to the melting point of alumina (over 3630 deg. F.)

The $FeO.Cr_2O_3$ system does not appear to have been worked out.

Work has been carried out on the systems $MgO.FeO.Fe_2O_3$ and $MgO.Al_2O_3.Cr_2O_3$ though a great deal of this still remains unpublished. Russian workers studying the latter system between the limits: 20 to 40 per cent Cr_2O_3, 25 to 45 per cent Al_2O_3 and 18

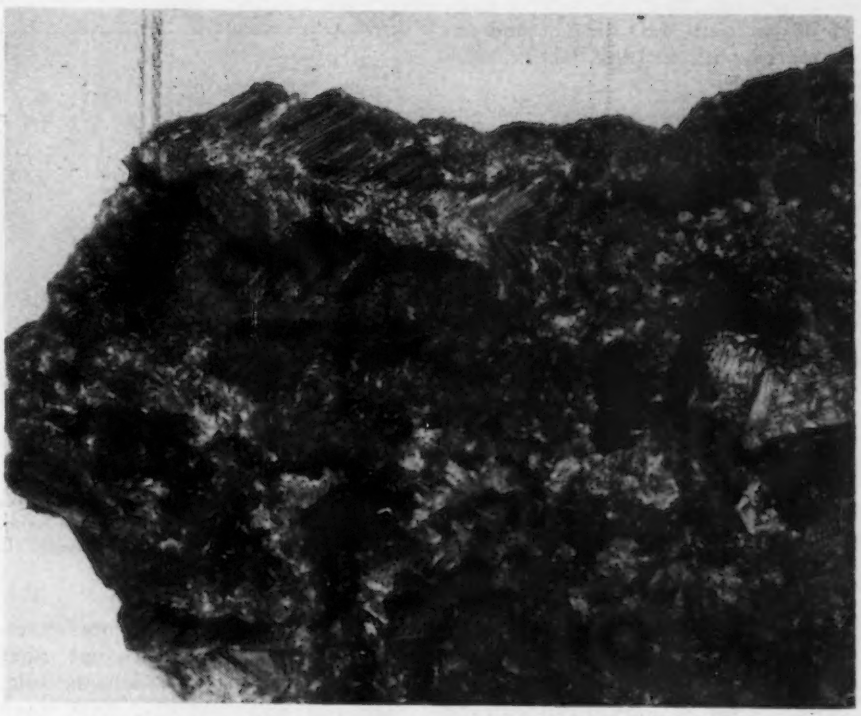

Fig. 1—Electrically fused spinel, showing triangular shaped crystals.

LEFT

FIG. 2—Section through chrome ore showing triangular cleavage and dark inclusions.

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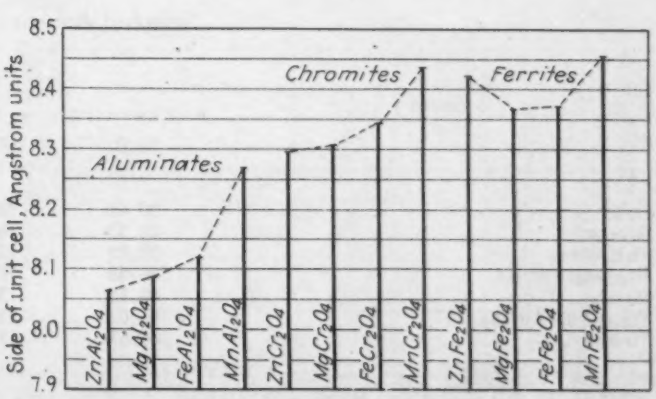
RIGHT

FIG. 3—Lattice dimensions of synthetic spinels. Chrome ore, being a solid solution of various spinels, has an intermediate lattice.



to 30 per cent MgO did not find any mixtures with melting points below 3630 deg. F.

Magnesite has already been discussed (see THE IRON AGE, June 3 and 10, 1943), therefore the present section deals only with chrome ore.

Table III shows typical analyses of chrome ore from various parts of the world. It will be seen that chrome ore from Cuba or the Philippines is high in alumina, while that from the Transvaal is high in FeO. These differences have a marked effect on the properties of the ores and in particular on the ease with which they can be handled in chrome and chrome magnesite brick production. In addition to a spinel, these ores always contain one or more secondary components; usually magnesium silicates. Other minerals, for example, quartz and free iron oxide, have been found but, as Seil states, the composition of this secondary component usually varies, as far as magnesia-silica ratio is concerned, between $3MgO.2SiO_2$ and $2MgO.3SiO_2$. Most of the ores examined contained serpentine, but other magnesium silicates, such as talc, forsterite and enstatite, have been found.

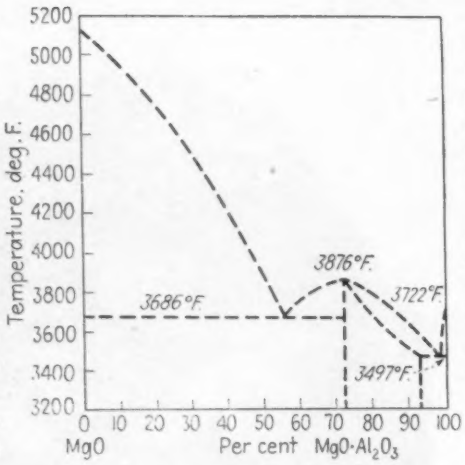


FIG. 4—The system $MgO-Al_2O_3$. Note the high refractoriness of mixtures of magnesia and spinel. (G. A. Rankin and H. E. Merwin.)

It is generally true that if the chromic oxide and alumina are considered as combined with the FeO and sufficient of the MgO to give a balanced spinel, the remaining MgO gives with the silica the general type of magnesium silicate mineral present.

One of the very important characteristics of a chrome ore is the distribution of the gangue. Fig. 5 shows an extreme case in which the chromite particles are floating in a matrix of serpentine. In general, the gangue content is far lower and occurs either as a coating around the grains or in fissures running through them. The serpentine gangue in Fig. 5 has a micro-structure as shown in Fig. 6. This is characteristic of serpentine ($3MgO.2SiO_2.2H_2O$) and its identity has been confirmed by X-ray examination.

A number of changes occur when chrome ore is fired. Thus, if the temperature is sufficient, the gangue melts and automatically re-distributes

TABLE II
Some Properties of Spinels

	Spinel $MgAl_2O_4$	Picrochromite $MgCr_2O_4$	Chromite $FeCr_2O_4$	Magnesio-ferrite $MgFe_2O_4$	Hercynite $FeAl_2O_4$
Color: In bulk	White	Reddish-gray in artificial light; green in daylight	Black	Reddish-brown in artificial light; purplish-brown in daylight	Greenish-black
Under microscope	Colorless	Pale green to colorless	Deep red	Brownish red	Pale green
Refractoriness	Above cone 35-36 > 3235 deg. F.	Above cone 35 > 3220 deg. F.	Above cone 35-36 > 3235 deg. F.	Cone 26-27 2875 deg. F.-2930 deg. F.	
Powder density	3.548 3.545 3.57	4.392 4.395	5.221 5.221	4.201 4.201 4.481	
Refractive index	1.72	1.90	2.12	2.35	1.80
Magnetism	Non-magnetic	Non-magnetic	Non-magnetic	Strongly magnetic	Non-magnetic

TABLE III
Selected Analyses of Chrome Ores

Country	Analyses, Per Cent					
	Cr_2O_3	FeO	Al_2O_3	SiO_2	CaO	MgO
Cuba	30.48	14.20	27.48	6.09	0.88	18.33
Greece	38.33	15.70	21.62	4.68	0.61	16.48
Philippines	32.09	13.00	27.61	5.31	1.05	18.18
Rhodesia (Africa)	46.46	12.81	15.42	7.02	0.88	13.69
Russia	46.19	15.63	14.58	3.96	0.31	15.39
Transvaal (Africa)	45.02	25.73	15.05	1.76	0.74	9.82
Turkey	46.57	12.89	12.50	6.74	1.16	17.25

After G. E. Seil—Industrial Rocks and Minerals, A.I.M.E., 1937, p. 205.

FIG. 5—Samples of Shetland chromite showing the distribution of the gangue material.

itself. Many brick manufacturers prefer such prefired ores, though the cost of the final brick is, of course, considerably increased.

The dehydration of serpentine on firing a chrome ore is shown in Fig. 7. It will be seen that most of the water of crystallization has been driven off by about 1300 deg. F. temperature. The product of this reaction is not a mixture of magnesia and silica or even of forsterite and enstatite.

X-ray examination shows that even after half an hour at 1300 deg., the crystalline part of the product consists wholly of forsterite. In same ores, for example, that from the Shetland Islands, the serpentine has a refractoriness of over 3100 deg. In others, it is much lower and a considerable number of tests have been carried out in the author's laboratory to determine the effect of various additions such as FeO, CaO, alumina and titania. It was found that lime, alumina and titania all have a serious influence on the gangue, but that iron oxide or mixtures of iron oxide and lime may even raise the refractoriness-under-load of 80-20 mixtures of gangue and magnesia, apparently due to the better crystallization of the forsterite which results.

TABLE I
World Production of Chrome Ore in 1938
(Gross Tons)

British Empire	408,000
Southern Rhodesia	183,083
Union of South Africa	173,773
India	44,149
Greece	41,793
U. S. S. R. (no data for 1938; production in 1936 = 216,000)	
Yugoslavia	49,401
Cuba	36,739
Philippines	38,271
Turkey	210,256
New Caledonia	51,391

(Data abstracted from "Chrome Ore and Chromium," Imperial Institute, 1940, R. Allen and G. E. Howling.)

In addition to the properties given above for chrome ores, X-ray examination shows peculiar variations in crystal size, and orientation. The investigation has been limited to some 30 samples, but within this range there would appear to be a marked correlation between the origin of the ore and the type of pin-hole pattern which it gives. Thus Grecian chromite is shown to consist of large crystals, as great as those in electrically fused magnesia, and having no obvious preferred orientations. Electrically fused chromite and certain African ores also contain large crystals, though not so large as those observed with Grecian chromite. Turkish, Cuban and Indian ores show much smaller crystals and preferred orientation. In a third class, which contains a number of African ores, the crystals are exceedingly fine and show little or no preferred orientation. This method of identifying chrome ores is still relatively undeveloped but has already proved of considerable practical value both with ores and with chrome-magnesite bricks.

Editor's Note: Next week, concluding his article, the author discusses the manufacture, properties and applications of chrome and chrome magnesite brick, and of other composite refractories containing chrome.

FIG. 6—Microstructure of the serpentine gangue in Shetland chromite. Crossed nicols; enlarged 75 diameters.

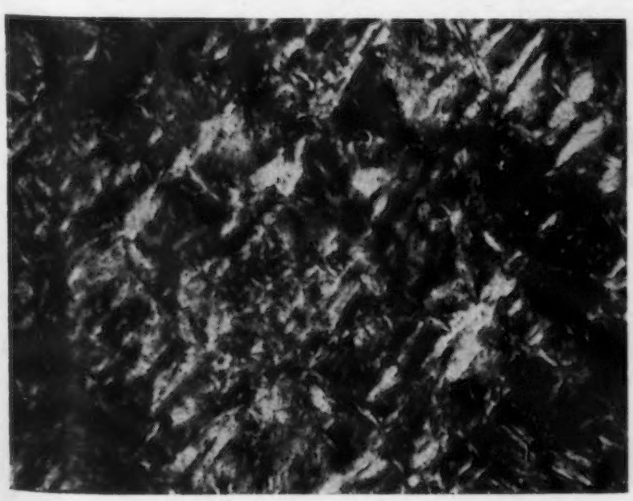
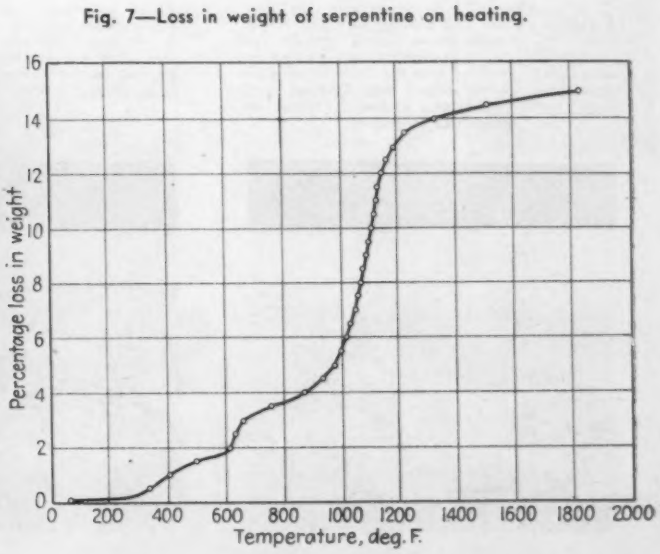


Fig. 7—Loss in weight of serpentine on heating.



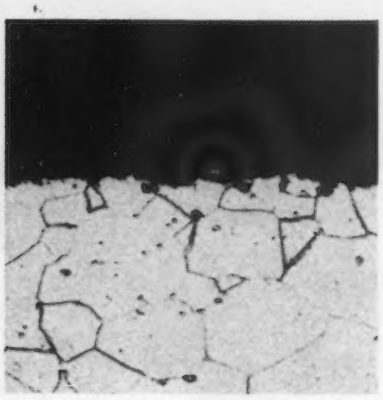


FIG. 1—Severe etching of the steel but no coating is shown after a 7-min. dip in a 5 per cent phosphoric acid solution. No silver plate was applied. Etched in Nital; enlarged 500 diameters.

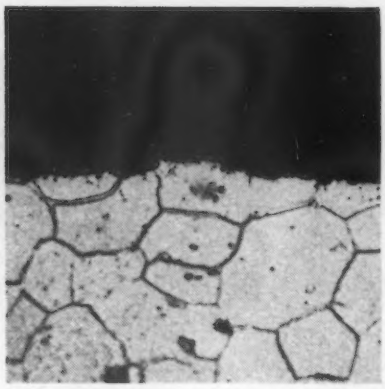


FIG. 2—A 0.00003 in. phosphate coating is shown on the etched surface of the steel after a 10-min. dip in acid zinc phosphate solution. No silver plate was applied. Etched in Nital; enlarged 500 diameters.

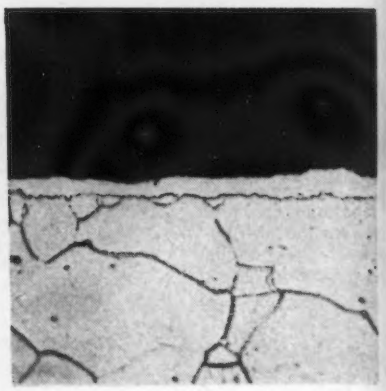


FIG. 3—After a 1-min. dip in acid zinc phosphate solution and plating with 0.00025 in. of silver, the sample shows an etched steel surface, a thin phosphate coating and the silver plate extending into the crevices or grain boundary in the metal surface. Etched in Nital; enlarged 500 diameters.

Phosphating Prior to Silver Plating of Steel

THE corrosion resistance of steel is usually not improved by the application of a thin coating of silver. On the other hand phosphating the steel surface does improve its corrosion resistance. A combination of the two processes has been tried in the past but results have not been conclusive. A recent investigation of the subject undertaken for the Electrochemical Society by Philip J. Lo Presti, Rochester, has resulted in the finding that silver plating steel after phosphating markedly improves the adhesion of the silver to the steel. It appears that although most, if not all, of the phosphate coat disappears during the first stages of silver plating, the phopshate coat protects the steel surface during that brief interval before the silver is discharged and deposited.

As shown by photomicrographs (Figs. 1 to 6) the investigation indicated that with a zinc phosphate-phosphoric acid solution it is possible to deposit a phosphate coating on steel. If only a light phosphate coating (produced in about 1 min.) is used as a basis for silver plate, it is possible to obtain a smooth silver plate which shows a test for phosphate after stripping. If a heavy phosphate coat is applied, the silver strike will remove nearly all of the phosphate coating before striking is completed and expose a more highly etched steel surface, consequently a rougher silver surface will result.

The photomicrographs show that most of the phosphate coat is removed during striking. They also show that adhesion of silver to steel is consistently excellent. Barrel burnishing likewise showed good adhesion.

Corrosion tests, comprising complete submersion in saturated NaCl solution, showed, after 4-hr. exposure, 50 per cent more corrosion of the standard silver plate than of the phosphated silver samples. However, after 24-hr. exposure, the amount of rust seemed about the same for both standard and phosphated samples.

A light phosphate coat on steel before silver plating will protect the steel against oxidation. During silver deposition in the strike solution the phosphate coating will almost all disappear, and the silver will deposit deep into the grain boundaries resulting in a firm anchorage of the silver deposit to the steel surface.

This interesting result of the phosphate dip preliminary to silver plating suggests a simple solution of the ever present difficulty of preventing oxide or sulfide films on steel after careful cleaning preparatory to plating. The principle involved should be applicable to other metals besides steel; a thin protective coating may be developed or applied to the clean metal surface during the last steps of the cleaning operation and be of such a nature and consistency that it will largely disappear during the first stages of the plating operation.

FIG. 4—After a 1-min. dip in acid zinc phosphate solution and plating with 0.001 in. of silver, the sample shows lightly etched steel surface, a trace of phosphate coating and the silver plate entering into the crevices or grain boundaries of the etched steel surface, indicating good adhesion. Etched in Nital; enlarged 500 diameters.

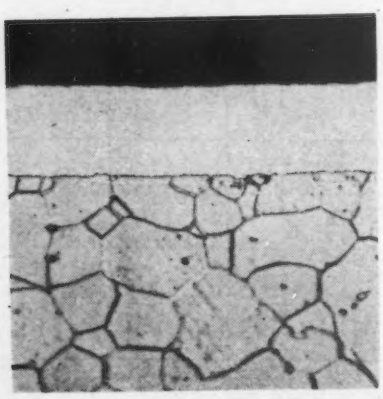


FIG. 5—After a 1-min. dip in acid zinc phosphate solution and plating with 0.000625 in. of silver, the phosphate coating on the steel can be distingished. The silver is deposited in the grain boundaries of the steel base. Etched in Nital; enlarged 500 diameters.

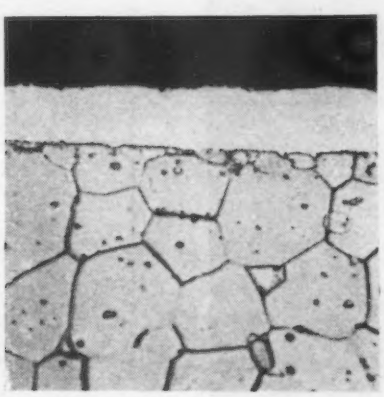
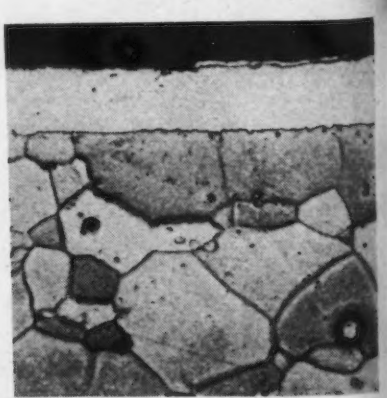


FIG. 6—Sample dipped in acid zinc phosphate solution for 3 min., plated with 0.000625 in. of silver, and then barrel burnished for 1 hr. The phosphate coating is hard to distinguish and the top of the silver plate is quite rough. Excellent adhesion between silver and steel is shown. Etched in Nital; enlarged 500 diameters.



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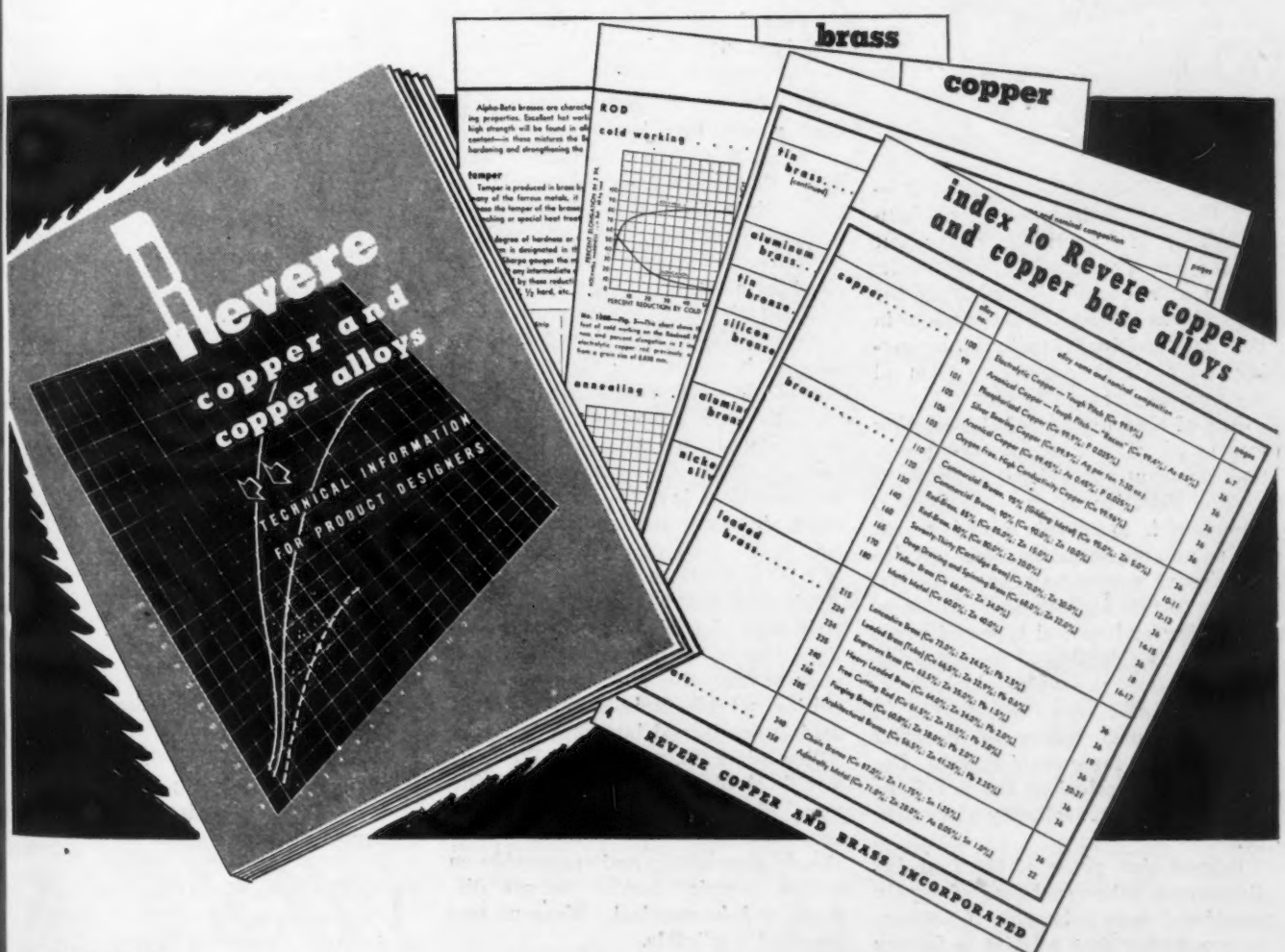

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PATTERSON FIELD, OHIO — General satisfaction with handling of supplies for the Air Forces was expressed for the public record at a conference called by the Air Service Command last week in Dayton, participated in by high-ranking Army Air Forces officers from all the war theatres.

One of the purposes of the meeting was to set up a unit packaging system for advance echelons. In general, a field objective of the Air Service Command is to provide a 30-day float of parts requirements for service squadrons accompanying tactical groups to new airdromes. Methods of packaging and special types of boxes occupied considerable of the attention of the conference—topics which, in all likelihood, will soon be reflected in new procedural orders to factories producing air force requirements. Details on the conclusions reached, however, were not immediately made public.

Beyond that phase of the four-day discussions, other problems of supply considered were primarily of military nature, rather than relative to factory production and shipment problems.

Industrial sources were somewhat puzzled with the air of sweetness and light which hovered over a press conference at which the war theater officers heaped their praises on ASC. This perplexity grew out of the fact that factory men have heard in the very recent past that Air Force shipments abroad have been arriving late and occasionally in bad shape, and that as a result many aircraft in fighting theatres have been grounded from time to time for lack of spare parts.

Even if there had been no rumors in industry of difficulties in shipping and handling of spare parts, there would have been grounds for questioning the harmonious air of the meeting simply because of the personnel involved. Officers from all the war theatres flew to Dayton for the meeting; on hand were five brigadier-generals, a score of colonels and lieutenant-colonels, and many other ranks as well. All these men are executive officers in the field. Their presence at Dayton, away from the fronts, could hardly have been necessary simply to express the gratitude of the field to the domestic echelons of supply and to study routine problems.

At any rate, the meetings indicated that refinements have developed in spare parts ordering during the past year, developed from battle experience. Since the first of the year, the conference stated, some $500,000,000 in orders for spares have been canceled as a result of this experience, with certain items cut as much as 70 per cent. Major reductions have been effected in spares for airframe components, in oxygen tanks, and in landing gear needs. Cannibalizing of damaged planes—stripping them of unharmed parts—accounted mainly for the reductions in the requirements for extra airframes and landing gears.

INDICATION came from the conference that the need for landing strip mats for airdromes would continue steady. It was pointed out that even though the need for such facilities would diminish as advance fields were turned into rear bases by Allied advances, removal of the mats would obsolete the fields requiring them. Too, many mats become bent in use, although they continue operational; disassembly and reassembly on a new terrain thereby become difficult and impractical. Wearout was reported negligible.

Some clue to the present heavy requirements for sheet steel came during discussions of gasoline requirements for advancing forces. Front-line contingents move gasoline, oil and petroleum products in 5-gal. cans, utilizing drums later and only after the bases are solidly established. When it is considered that fighting in North Africa during one recent month required many tens of thousands of tons of aviation petroleum products, much of it packed in tins whose content weighed about 30 lb., the extent of light sheet requirements for such containers alone becomes obvious.

The conference mulled over the problem of parts number identification which has bothered other service arms as vexatiously. Parts numbers are often keyed from blueprints; identical parts from different manufacturers therefore may carry different parts numbers. The ASC has set up parts interchangeability tables to be used by field personnel, and is trying to develop means of eliminating many of the contradictory numbers. There were no indications, however, that a solution had been reached.

One anecdote typical of ingenuity in solving field problems, told at the conference, deserves repeating. At a North African depot one day a number of P-39 aircraft arrived which were grounded there because of defective cast rudder hinge bracket fittings, broken during a storm enroute.

The problem was turned over to Maj. L. F. Green, formerly a metallurgist on the faculty of the University of Oklahoma. He obtained asbestos from a nearby city and built a crucible, then made a core box of ordinary building brick. He joined the pieces of one broken casting with beeswax, then used ordinary plaster of paris to make a mold. For materials to cast, he melted a mixture of 95 per cent pure aluminum, obtained from propeller blades of downed German planes and damaged P-40 blades, plus 5 per cent of pure copper. Heated to 920 deg. F., this melt was poured and later heat treated. Tests made at the base indicated the castings satisfactory, and the flight of P-39's went on its way; complete test results later made in this country confirmed the findings at the field.

THE Air Service Command is the storekeeper and express company of the AAF, operating 11 main supply and maintenance depots and some 300 sub-depots and specialized depots in this country, as well as numerous similar installations in the theaters of operation. Inasmuch as the Air Forces has had top priority in obtaining any material desired, the storage bins of the ASC are wonderful and amazing to behold. Stocked are some

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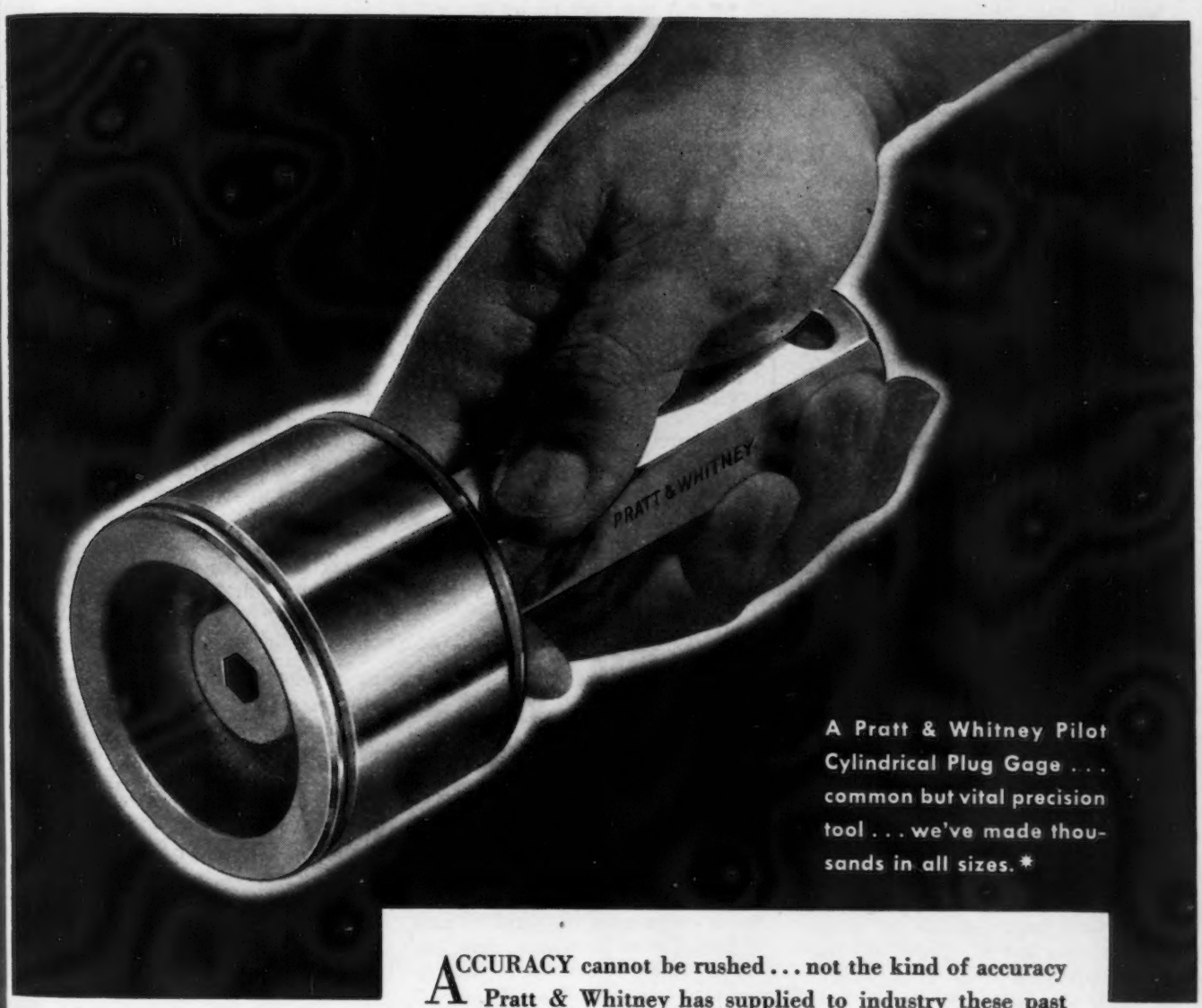

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The Air Forces appear to have built up tremendous quantities on many of these warehoused items. Already one bitter fruit of this upbuilding has been harvested in small fraction at Detroit, where the disposal of surplus tools (The Iron Age, Sept. 30, 1943, page 66) created a hue and cry whose harshness quickly attracted the Truman committee. Part of these tools were obsoleted by changes in contract, but the quantities were definitely breath-taking, indicating that had the contract been continued unchanged, equipment would have been sufficient for a lengthy production period.

Similar heavy stockpiling is newly indicated in a catalog which is currently being distributed by the 830th Army Air Forces Specialized Depot at 3300 Jackson Ave., Memphis 1, Tenn. This professional looking catalog lists for sale to "manufacturers and suppliers under existing regulations" a most remarkable variety of available material.

There are electrically heated coats for flyers, and 16 mm. film projectors. There are wrenches, hammers, chisels and pliers. There are seats, designed for aircraft use but usable almost anywhere, and seat cushions. There is turpentine and nitric acid in drums.

There is, from another standpoint, a surprise on every page. Surprise that so many standard items are already listed as surplus, surprise that so many of the items are evidently drawn right out of the civilian manufacturing economy, rather than the extraordinary war production effort. No cracker jack box with a prize inside ever promised as much in the way of hidden treasure for a boy as this catalog presages for merchandisers and the general public at the end of the war.

8,362 Planes Made For October Peak

• • • A new high record in aircraft production was set in the United States in October when 8,362 planes were turned out, including the largest number of heavy bombers ever made in a single month. This was announced by Donald Nelson of WPB last week

The gain in October production, amounting to 764 planes, or 10 per cent, compared with September, is traceable in part to increased labor productivity in the airplane industry, Mr. Nelson said.

Average monthly air frame weight output per employee now approximates 60 lb. compared with 28 lb. in January, 1941, Mr. Nelson revealed.

Construction Nearing Completion On New Detinning Plant in South

Cleveland

• • • The Birmingham, Ala., detinning plant, being built by the H. K. Ferguson Co., will go into production around Jan. 1, 1944. It will be one of the nation's largest plants for detinning tin cans and will have facilities for handling both prepared and unprepared cans.

Using the Metals & Thermit Co. process, Johnston & Jennings Co., Cleveland, will operate the new unit.

The unprepared cans will be brought in by rail on a siding and will be unloaded by a bucket crane into a hopper through the roof of the building adjacent to the tracks.

The cans then proceed to a shredding machine that breaks them up into small pieces. From the shredder they pass into a low temperature controlled atmosphere furnace. This chars the paper and other non-metallic adherents to the can, but does not affect the tin. If the temperature of this furnace is too high, the tin and iron would form an amalgam that could not be separated. Thus, the furnace must not exceed a temperature of about 400 deg. F. Also, the oxygen content of the furnace atmosphere must be kept very low, below 2 per cent. To accomplish this, the gases of combustion are recirculated into the furnaces atmosphere. This also serves to conserve the heat of the unit.

From the furnace, the shredded cans are passed over a shaker that jars loose the charred particles, separating them from the metallics. What isn't separated in this manner is removed in a hot water wash that immediately follows.

Not too much has been revealed as to the actual detinning process, but it is believed that the process is purely a chemical one that converts the metallic tin on the cans to oxide form. Heated baths speed the chemical reaction, and the tin oxide settles out of the bath to the bottom of the processing tanks where it can be removed. As the tin is removed from the shredded cans, the remaining steel passes into a bailing or bundling press and is prepared for shipping to steel mills.

The tin oxide, however, that is recovered is dried, bagged, and made ready for shipment to the tin smelter. As there is only one smelter in this country, the entire output from this detinning unit will in all probability go to the Texas City, Texas, smelter.

With prepared cans, those washed and cut in accordance with the Tin Scrap Drive regulations by the housewives, all operations up to the actual detinning can be eliminated. That is, there is no necessity for shredding, burning, shaking, or washing. This not only serves to decrease cost of operation of the plant, but also speeds up production.

The Defense Plant Corp. is financing the Birmingham, Ala., detinning project, which originally was only one of about 26 such units contemplated. However, early in 1943 contracts for all but this unit were cancelled.

28 Electrolytic Lines Is Total, Instead of 27

• • • On page 102 of THE IRON AGE, Nov. 4, a table showing the status of electrolytic tin plate lines indicated that six were now operative at Carnegie-Illinois Steel Corp. This should have been seven. The Tennessee Coal, Iron & Railroad Co. was shown as having one operative and two to be ready by the end of the year. This should have been two now operative and one to be ready by the end of the year. The total number of lines should have been 26 now operative, and two ready by the end of the year, making a total of 28 instead of 27.

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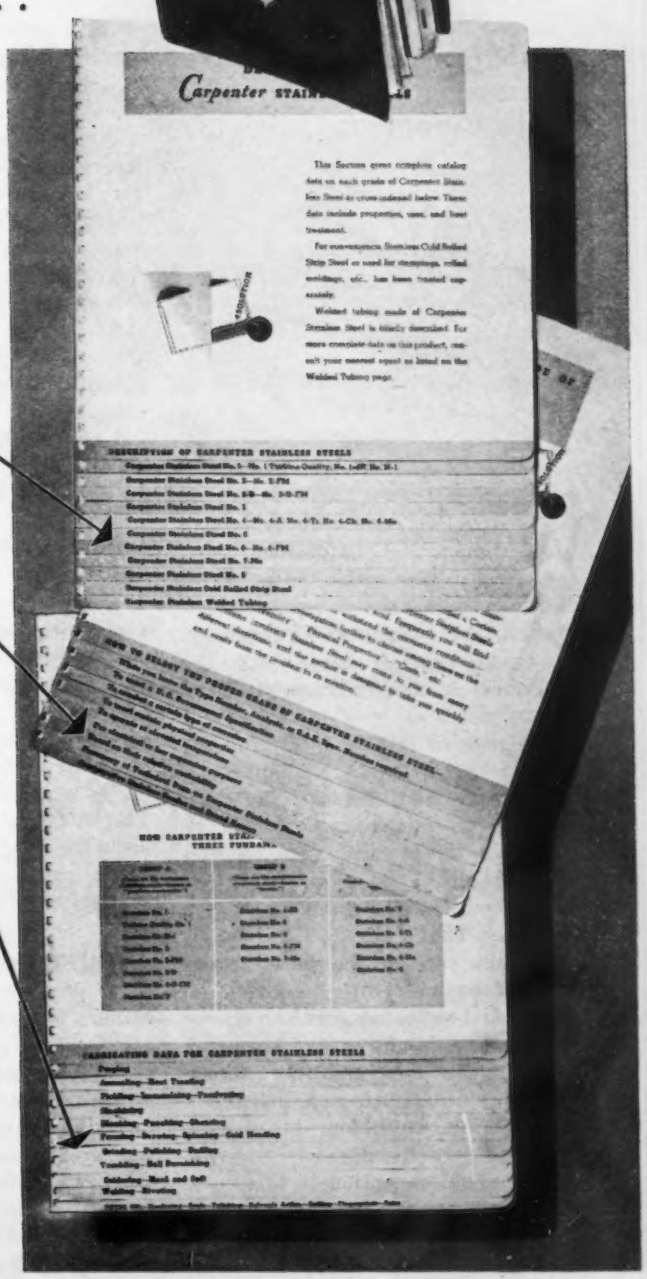
Fabricating information on these step-down pages is indexed by operation such as blanking, forging, etc.—



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Longer Product Life
Sales Appeal

BRANCHES AT
Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

Washington . . .

L. W. MOFFETT

• Warning: Hold your rose colored glasses tightly (if you are wearing them today) before reading this piece about business outlook . . . WFA after peak food program . . . Plate future still tight . . . McCarran á la European.

WASHINGTON — If American competitive capitalism survives the cathartic of renegotiation, the emetic of contract cancellation, the queasiness of reconversion, the sweat of taxes, and the nightmare of bureaucracy, it may live.

If it lives it still has to fight the socialistic ambitions of Administration-inspired labor leaders, the pork barreling of demagogues elected to Congress, government competition and the rigors of an economy threatened by colossal government material surpluses. That's all.

War has thrown the present and future of business into the hands of hammer-and-sickle lawyers and economists in the executive agencies and in Congress. The engineer whose job it is to correlate men, machines and materials is seldom heard and less frequently hired. The services form a partial exception to this rule.

Corporate finance has been plunged into a maelstrom of confusion because there cannot be any certainty of reconversion until the government settles on practical, uniform and honest programs for taxes, termination and renegotiation. These programs must be based on known financial and physical conditions of industry. They must not be based on ignorance or wishful theory. Congress has rightly assumed the task and it is hoped that it will resist improper executive agency pressure in the solution of the problems.

Reconversion depends in part upon the allowances of adequate post-war reserves. It depends a great deal on the final disposition of government excesses in machines, war material and goods suitable for civilian consumption. No workable solution to these problems has been offered by industry or government.

Labor must discipline its leaders and its organization because government will not and management cannot. Management can only tell the people its problems. Unstable industrial relations might be the very thing to touch off a social and economic conflagration which would be equally damaging to organized labor and to industry, thereby preventing industrial recovery.

Labor must be convinced that it can get its feet under the table without resorting to outrageous demands. At the same time, management must be prepared to pay high wages for a workweek of reasonable length, and to provide clean, safe, working conditions.

A new, conservative, yet intelligently progressive government for the post-war administration, a government which would encourage the employment of technical advisers, and keep government industrial controls to a minimum, is a goal to be hoped for by every right-thinking American. This includes Congress, and does not mean the public should vote for a man just because he carries a Republican or Democratic party label.

HUNG on the hopes and fears of post-war business, farm machinery manufacturers have made the astounding request that government controls be continued until there can be an orderly letting up of companies to civilian production. The reason is that every manufacturer is afraid another will gain a competitive advantage if allowed to go to work on a peacetime basis first.

The War Food Administration has requested an increased allowance of steel from WPB for farm machinery. The new request for steel is 1,100,000 tons for 1944, which is about 22 per cent more than was allotted in 1943. However, first and second quarter WPB allowances (the farm machinery year begins July 1) were for greater amounts of steel than were received by farm machinery manufacturers during the whole calendar year.

WFA is asking for complete control of its steel supplies so that it can award them to manufacturers best capable of making the most farm material. Tinplate requests will amount to 1,790,000 tons for the 1944 foodpack.

Tractor production is likely to be below goals set by WPB for next year. WPB is calling on manufacturers to make about 155,000 tractors and is worried over the fact that industry is currently about 25 per cent behind schedule.

While aware that truck and tractor bearings, tires, engines, carburetors, magnetos, valves, transmissions and radiators are short in supply, WPB has called on farm machinery manufacturers to say what they can produce and then be held responsible for procurement of the components.

Manufacturers say that this is a political squeeze, calculated to shift blame from WPB to industry in the event there is any great tractor shortage next year.

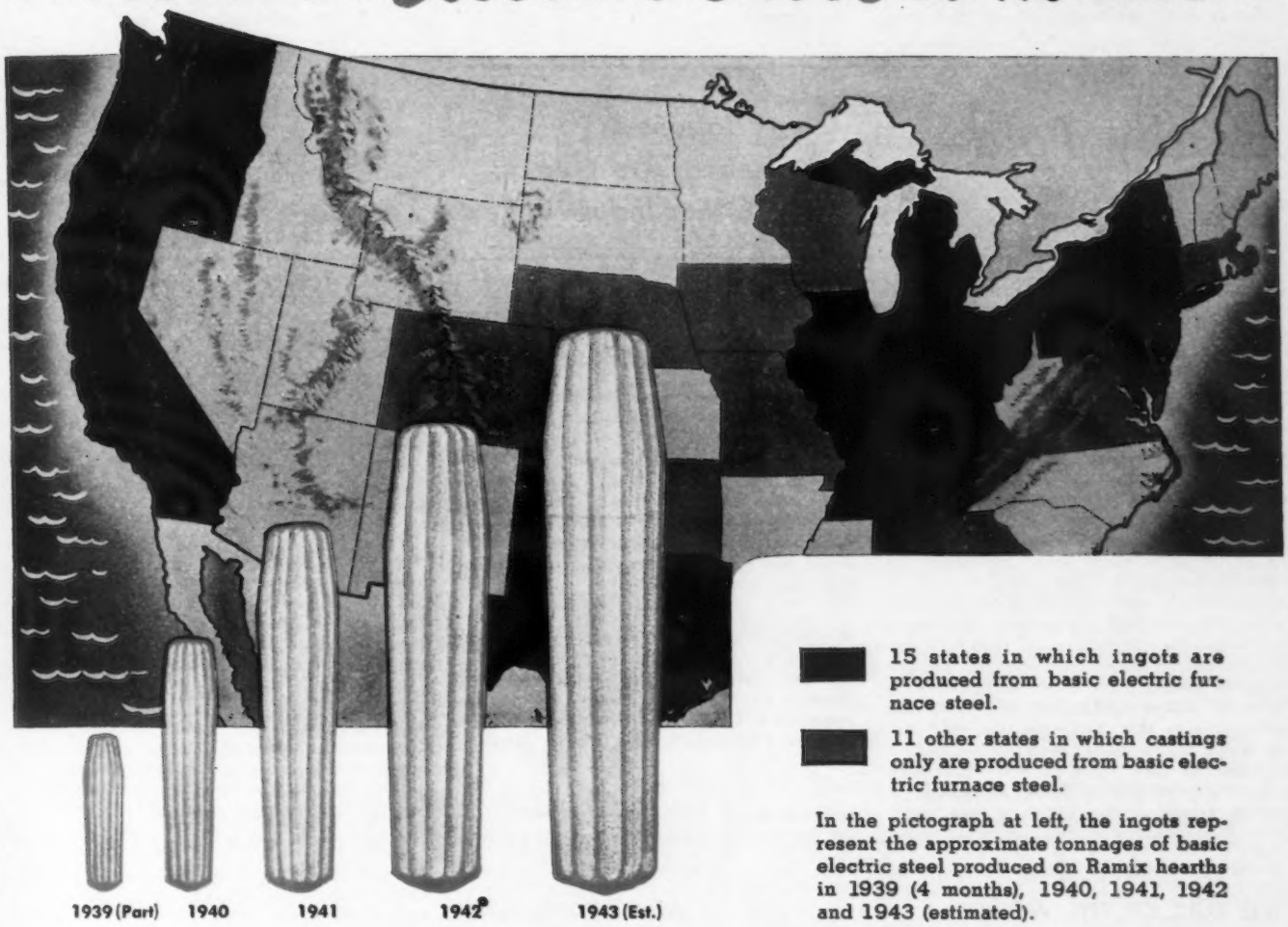
WPB expects that October plate production will leap up to 1,147,000 tons despite losses from the coal strike and labor slowdowns. This is about 40,000 tons more than were rolled in September.

Maritime Commission demands for plate continue to be high. WPB says that there will be a 20,000-ton increase in the allotment in the first quarter of next year over those allocated in this quarter. First quarter allocation will be 1,680,000 tons to be supplied at the rate of 560,000 tons a month.

WPB blames heavy Maritime Commission demands for plates for the tightness of flat rolled products. Officials declare that cancellations are taking up the over-orders placed by the WPB Steel Division on various mills to some extent.

AS difficult to accomplish as the proposal of Senator McCarran for the decentralization of American industry will be the American suggestion of the same idea to be applied to liberated Europe. The idea is different because the motive is to relocate all heavy European industry with a view to preventing future wars instead of furnishing some relatively innocent political pork in the form of electioneering talking points to American legislators.

Wherever Electric Steel is made...



15 states in which ingots are produced from basic electric furnace steel.

11 other states in which castings only are produced from basic electric furnace steel.

In the pictograph at left, the ingots represent the approximate tonnages of basic electric steel produced on Ramix hearths in 1939 (4 months), 1940, 1941, 1942 and 1943 (estimated).

RAMIX Will Speed Production and Guard Steel Quality

FOUR out of five basic electric steel producers make ingot steel on Ramix bottoms. A majority of steel foundries, too, use Ramix in basic electric furnaces.

Ramix was developed to meet the special conditions encountered in electrics. The first hearth was installed in August, 1939, cold rammed in a small furnace at a northeastern Ohio plant. That shop now has seven Ramix bottoms, representing 331-ton furnace capacity. Another plant has nine Ramix hearths. Over thirty have two or more. Each month sees a steadily mounting number of electric furnace installations.

Ramix, a *non-hydrating product,* is unique among refractories. It is a chemically-bonded magnesia clinker, designed to be cold-rammed—for either major repairs or complete hearth construction. A most obvious advantage is the time and labor it saves in refractory installation. It also means fewer repairs in service, less time for heat-to-heat maintenance and cleaner steel. If you are not yet familiar with all the possibilities of Ramix, why not let a Basic Engineer call at your convenience and tell you the whole story?

BASIC REFRACTORIES, INCORPORATED

CLEVELAND, OHIO

The proposal to relocate European heavy industries is being discussed in high government circles. It will surely meet with stiff opposition from Europeans who will not look kindly upon notions which may aggravate already grave post-war employment prospects.

Briefly Told— Cancellations In Canada Are Heavy; Other Industry News

• Within the past two months extensive war contract cancellations have been announced in Canada. These cancellations together with completed contracts which are not being renewed involve upwards of $100,000,000. While the major curtailment has been in shipbuilding (chiefly involving the 10,000-ton freighters) it also has affected various types of guns, tanks, shells and ammunition, numerous components, etc. The cancellations have resulted in the throwing out of their regular employment of thousands of workers. Most of them have been transferred or are in process of being transferred to other plants and operations. Most types of equipment that have been abandoned have become obsolete as a result of improvement on the battlefronts, or because surplus stocks have been established to a point where additional output is not necessary at this time. Against this curtailment there have been introduced a number of new lines of war materials, chiefly under the heading of guns for which retooling recently has been completed or soon will be and it is these plants that are absorbing many workers that have been released through the suspension of other work.

•

• Artillery officers have elevated the U. S. 4.2-in. mortar above the famous French .75 of the last war, said Col. H. R. Lebkicher recently in a commendation to employees of Bell Machine Co., Oshkosh, Wis., a former match plant which makes the weapon. The new piece can be assembled in three minutes and can pour out shells comparable to the 155-mm. every two seconds. It can also be used for demolition work.

•

• The board of trustees of the American Society for Metals has approved a 1944 meeting for Cleveland next Oct. 16 through 20. The 26th annual Metal Congress and Conference Displays will be held in Cleveland's vast Public Auditorium

•

• Bookings of fabricated structural steel for the month of September, 1943, according to reports received by the American Institute of Steel Construction, Inc., amounted to 75,632 tons, as compared with 43,721 tons for the preceding month, and 68,520 tons for the corresponding month last year. Shipments totaled 56,361 tons and showed an increase over the 52,594 tons shipped in the previous month.

•

• With steel production averaging better than 100 per cent of capacity since Jan. 1, 1941, Republic Steel Corp. produced 24,121,000 tons of steel ingots during this 34-month period. In October the corporation set an all-time production record for steel ingots and operated at the rate of 107 per cent of capacity.

•

• Use of a pine wood chemical has sped production of armor steel castings for combat vehicles by smashing a foundry sand bottleneck, Hercules Powder Co. reported recently. Foundries have increased their use of mechanically-reclaimed old sand by mixing it with a pulverized resin.

•

• Shipyards of the U. S. delivered 163 cargo vessels in October, bringing this year's output to 1524 ships, and topping September by three vessels. Permanente Metals Corp. at Richmond, Cal., launched and delivered one ship a day to lead the parade.

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• "Seaporcel," the new single-sheet, lightweight bulkhead, made of Armco ingot iron and which does not require painting, is made by Porcelain Metals, Inc., of Long Island City, N. Y.

•

• In October the Jones & Laughlin Steel Corp. Pittsburgh Works broke its previous record, set one year earlier, for production of steel ingots and steel for castings. The bar mills of this works also broke their previous record while the hot strip-sheet mill broke its best record of May, 1942, for total finished products and of April, 1943, for plates. At Aliquippa, the No. 1 blast furnace and the sintering plant set new records. At Cleveland, the No. 2 blast furnace and the sintering plant broke records.

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• A new all-time world's record for monthly production of steel ingots was claimed by Carnegie-Illinois Steel Corp., with October ingot production of more than 2,000,000 ingot tons, exceeding by more than 71,000 tons the previous monthly record established last August by Carnegie-Illinois.

•

• A new world record in ship construction was claimed Nov. 3 by the Bethlehem-Hingham Shipyard when it delivered the 1300-ton Destroyer-Escort Reynolds within 25 days of the time the keel was laid.

•

• Absenteeism in August as a result of sickness, non-industrial accidents, and personal reasons caused the loss of 39,550,000 man days, according to estimates based on the regular monthly survey of the National Industrial Conference Board. This figure is almost 4,000,000 man days greater than the 35,680,000 man days lost for the same reasons during July.

THE BULL OF THE WOODS — BY J. R. WILLIAMS

I DON'T THINK, EVEN AFTER CROWDIN' IN ON THE INDIANS, WE'D OF HAD MUCH TROUBLE WITH 'EM IF TH' NEWCOMERS HADN'T TRIED TO MAKE 'EM CLEAN UP THEIR WIGWAMS!
I THINK TH' WORST TROUBLE CAME WHEN TH' NEWCOMERS TRIED TO MAKE 'EM CLEAN UP TH' NEWCOMERS' WIGWAMS-- IN OTHER WORDS, MAKE 'EM WORK FER US!
J.R.WILLIAMS
T. M. REG. U. S. PAT. OFF. COPR. 1943 BY NEA SERVICE, INC.
THE OLD CHIEF
11-12

PRODUCTION THREAD-GRINDING *at Lower Cost*

Aircraft Engine Parts
Instrument Parts
Ordnance Components
Machine Tool Parts
Precision Mechanisms
Threaded Production Parts
Gages

Finished thread completed quickly in one plunge cut with the multi-ribbed wheel—longer threaded sections produced by *traverse grinding.*

Grinding time reduced 50-75% on multiple threads ground in one pass—no precision indexing.

Machine capacity is sufficient for 90% of all grinding needs—can be used both for production and gage work.

Commercial production thread grinding more economical than ever. Threads produced by other methods may now be ground with Sheffield Precision Thread Grinders.

No. 100 SERIES SHEFFIELD PRECISION THREAD GRINDER

The first American designed thread grinder available commercially on which either multi-ribbed or single-ribbed wheel may be employed.

WRITE FOR FULL DETAILS
BULLETIN M-100-143

SHEFFIELD MASTER CRAFTSMEN

THE SHEFFIELD CORPORATION

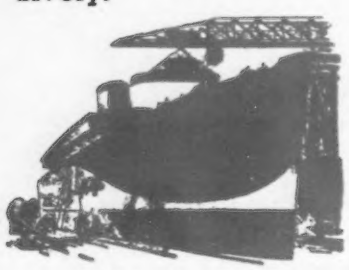
Dayton 1, Ohio, U.S.A.

MACHINE TOOLS—GAGES—MEASURING INSTRUMENTS—CONTRACT SERVICES

ARMY E NAVY

WEST COAST . . . OSGOOD MURDOCK

• Industrial engineers visualize a single Army or Navy man as production management director over all existing agencies on the West Coast, with power and disposition to act positively and decisively.



SEATTLE—Down at Tulelake on the Oregon-California border they called in the Army last week with a few Tommy guns to quiet decisively several thousand "segregated" Japanese, disloyal culls from all Relocation Centers who consistently resisted and refused to cooperate with federal civilian authorities attempting to preserve civil liberties and maintain order and respect along conventional, peacetime, normal lines.

Many thoughtful citizens especially concerned with industrial and production management on the West Coast were wishing that the Army or Navy might also be called in with one or two Tommy guns to take over the direction of manpower and essential war production at principal West Coast centers. One salty, forthright admiral, or a hard-boiled, firm-jawed general could so decisively end the months of too-close-to-the-belt competition among industrialists, indecisive, bureaucratic jockeying among federal agencies and internecine struggles among and within organized labor to maintain social gains, strengthen organizational lines and grade up individual workers.

When Rear Admiral Edward L. Cochrane, chief of the Navy Bureau of Ships, outspokenly and publicly declared a few weeks ago that Puget Sound shipyards were overmanned with a surplus of labor, and when Army Supply Services, through Ordnance, insisted that tank and truck assembly lines be moved across the mountains to provide additional facilities and workers for aircraft assemblies, they did more to clear the war production atmosphere in the Pacific Northwest than all the manpower directives and civilian agency palliatives and expediencies of many months. After a few weeks of mild and futile resistance by labor stewards who may have been fronting for management, attempting to delay the shipyard layoffs, and in spite of instinctive alarm by commercial interests over the withdrawal or relocation of contracts, the situation has so improved and cleared within only a few weeks that the change in atmosphere is well nigh miraculous.

The Navy is still following through with its plan to make Puget Sound a major Pacific repair center. The Lake Union Dry Dock & Machine Works has been informed that, with the completion of its two minesweepers now in the water and a third nearly ready for launching, it will do only repair work. Officials at the yard say that the three ships won't be completed until the first of the year but necessary arrangements for increasing repair facilities will be made immediately. This yard is a branch of the Associated Shipbuilders and will have completed 16 of the wooden mine sweepers when those now building are delivered.

There is consistent expectancy and planning on the West Coast toward greatly accelerated Pacific action during the coming year, starting within 30, 60 or 90 days.

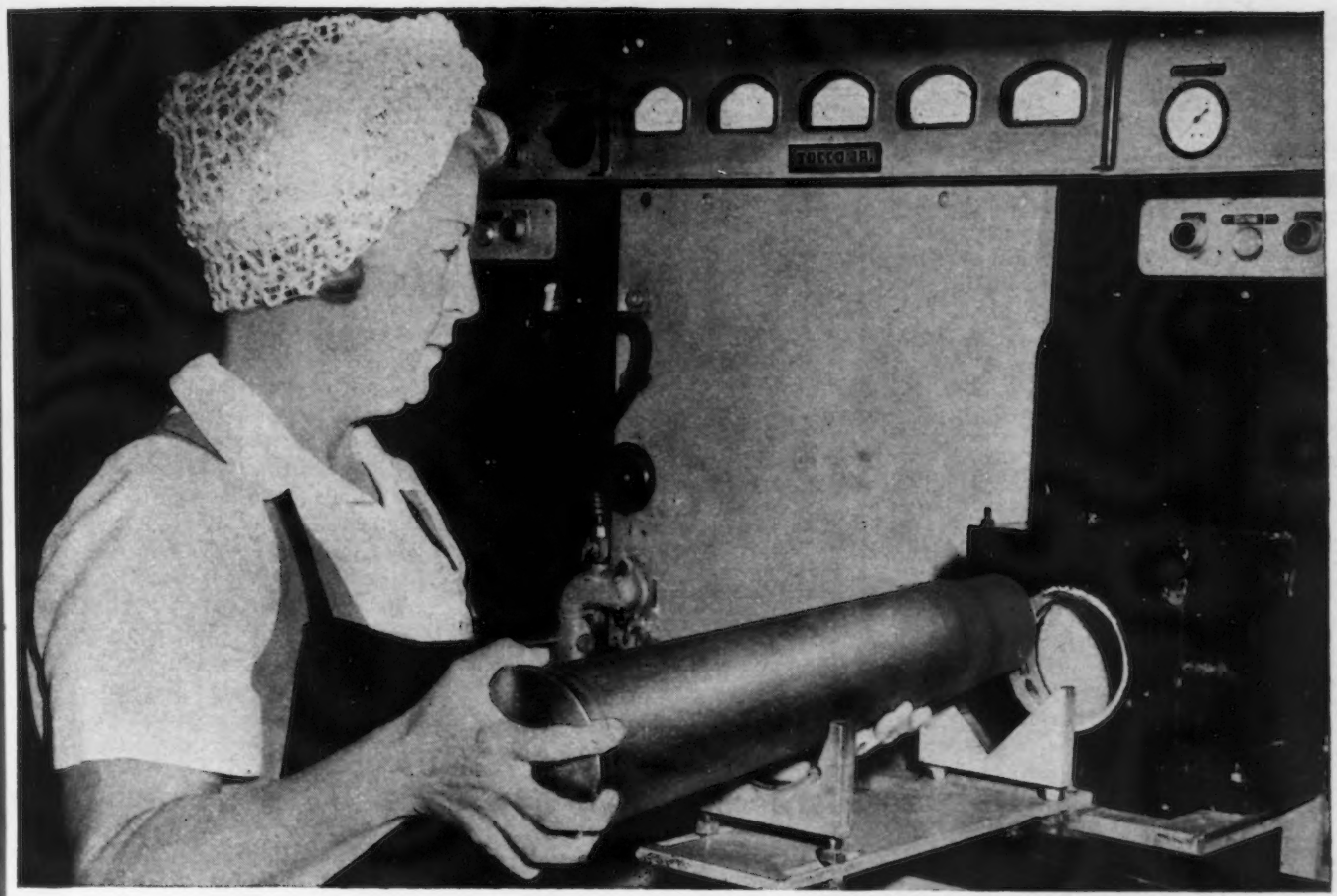
Pacific Car & Foundry can now admit that its Renton plant has been building M-25 tank retrievers, the biggest automotive unit the Army buys. Fruehauf Trailer Co. furnishes the trailers for this truck tractor from Vernon, Cal. These M-25 retrievers and the M-26 truck tractor will henceforth be constructed and assembled at the new Billings, Mont., plant, as P. C. & F. switches over to Boeing wing assemblies.

LOS ANGELES—That 10-hr. five-day shift plan which WPB requested southern California plane plants to adopt has, as usual with all requests and recommendations, precipitated debates, discussions and divided counsel. Big Douglas Aircraft with over 100,000 employees, 40 per cent of the entire southern California industry, has rejected the proposal and announced there will be no change in its present shifts at its California plants. A memorandum completely outlining the plan and considerations was circulated among all employees and rather thorough consideration accorded all factors before the decision was reached. "Unless further instructions are received from Washington, no changes will be made" was the verdict.

Douglas just now is pointing with pride to a labor dispatch system which is said to be saving more than 150,000 manhours monthly. Adjusting to the variable output of departments, fluctuating with the flow of raw materials, critical parts and sub-contracted units, workers are reassigned daily from departments whose output is temporarily retarded, to other departments where supervisors have requested additional personnel. It is reported that last month 573 departments participated and 475 separate employees were borrowed. Exchanges in one week involved 48,000 manhours.

North American, who originated the 10-hr. shift plan and adopted it voluntarily a month ago, is undertaking to maintain production schedules at its Dallas plants, at least until next January, with 10,000 less workers than previously scheduled and anticipated. Rescheduling the availability of raw materials and component parts cut 4000 men and women from previously estimated peak labor requirements. Because of increased efficiency and manpower utilization, a recalculation of the productive possibilities of the available labor force saved 6000 additional workers. The total savings is thus 10,000. It was announced that the reduction was completely agreed on mutually between WPB, WMC, the Army Air Forces and North American management.

It is becoming constantly clearer to practical production men and industrial engineers on the West Coast that future production, along with necessary transportation, material handling and shoreside Maritime and Naval activities, must be carried on by the present existing labor force. Moreover, practical management men believe that present facilities can be manned and schedules maintained with the present labor force, provided there is reasonable cooperation among military and civilian public officials and between management and labor. If management were asked for its present recommendation,



Courtesy Norris Stamping and Manufacturing Co., Los Angeles, Calif.

SOFTENING A HARD PRODUCTION PROBLEM

SEVERAL of the toughest problems in converting cartridge cases from brass to steel have been solved by TOCCO. For example:

Forming the mouth of 3″ case by cold-drawing causes work-hardening. This area should be ductile, to permit crimping to the projectile and to assure a gas-tight seal in the gun on firing. On the other hand, the side wall up to the mouth should be hard and "springy" to withstand the high firing pressures and still permit easy extraction of the case after firing. The hard-to-soft transition zone should be accurate.

The answer was found by annealing the cartridge case mouth. TOCCO Induction Heating applies a uniform amount of heat for an exact length of time to a definite, prescribed area of the case . . . softens the mouth without affecting the side wall . . . assures accurate results on every single piece at a high production rate.

Material treated is SAE 1030 spherodized steel. Heated to 1300° F. Heating time per shell 4 seconds. Hardness before, 98 R.B.; after, 70 R.B. Output per machine (2 stations), 1000 cases per hour. TOCCO machine is clean and compact; doesn't require skilled labor.

Find out how TOCCO can help solve *your* annealing problems . . . your hardening, brazing and heating problems, too . . . present and post-war.

THE OHIO CRANKSHAFT COMPANY, *Cleveland, Ohio*

TOCCO

HARDENING . . BRAZING
ANNEALING . . HEATING

★

it would probably favor replacing manpower directives and West Coast plants, so-called, with a single West Coast production director, with final authority and power over all agencies, preferably an Army or Navy man. There would then be final authority in a practical and positive production man, who would make decisions and stay with them, with power and disposition to see that they were reasonably and rather completely complied with.

STEEL plate is reported rolling through and from the Fontana mill of the **Kaiser Co., Inc., at or** above originally rated capacity of between 800 and 850 tons a day. This is about one-third of the present requirements of the southern California maritime shipyards and less than 10 per cent of the supply of plate for merchant ship construction on the West Coast. Although it takes little load from the overburdened transcontinental rails, because of the long haul on coal from Utah (830 miles) and ore (170 miles) it is nevertheless regarded by construction men and coast industrialists, as a big new jewel in the Kaiser crown of achievement that this sizable integrated steel plant should have been completely erected and get into full operation in 18 months, under war conditions, and in an otherwise and previously non-industrial location.

Steel Workers of America, CIO, have been refused a petition for an election in the Fontana plant by the regional NLRB on the ground that "a substantial number of employees are not yet employed and a substantial showing of representation among such employees has not been made."

COMING EVENTS

Nov. 10, 11—Industrial Hygiene Foundation, Pittsburgh.
Nov. 11, 12—American Marketing Association, Cleveland.
Nov. 17, 18—National Founders Association, New York.
Nov. 17, 18—Galvanizers' Committee, Pittsburgh.
Nov. 19—Steel Products Warehouse Association, Inc., Chicago.
Nov. 29 to Dec. 3—American Society of Mechanical Engineers, New York.
Dec. 6 to 11—19th Exposition of Chemical Industries, New York.
Dec. 8, 9, 10—National Association of Manufacturers, New York.
April 2 to 5, 1944—The American Ceramic Society, Inc., Pittsburgh.
April 12 to 15, 1944—The Electrochemical Society, Inc., Milwaukee.

Travel Time for Iron Miners Approved By Gov't.

Washington

• • • **"Miners are not only** employed during underground travel, but are engaged in hard work," a brief filed by Solicitor General Charles Fahy before the Supreme Court Nov. 3 stated in support of portal-to-portal pay for iron miners. The brief, stating the government's position, was filed to oppose a Supreme Court review of a Circuit Court decision involving the iron miners of Tennessee Coal, Iron & Railroad Co., Sloss-Sheffield Steel & Iron Co. and Republic Steel Corp., operators of 13 iron mines in Jefferson County, Alabama.

Tin Released for Civilian Articles

Washington

• • • **WPB has amended** Order M-43, adding to the list of items in the manufacture of which tin may be used, subject to limitations and to the extent that substitution of less critical material is impractical. Added items are piston rings for locomotives—not more than 20 per cent; thermostatic discs or diaphragms, bronze welding rods, foundrinier warp wire or rifle nuts in air hammers—not more than 9 per cent; for all other purposes not more than 5.8 per cent tin by weight for solder the tin content will vary from 5 to 50 per cent depending upon the purpose for which the solder is used.

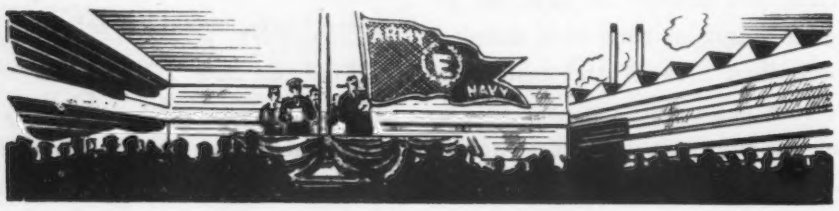
Similar limitations are imposed on the use of tin in babbitt metal. Tin may be used to coat or re-tin equipment used in the preparation or handling of any food by institutions or by industrial or commercial establishments, but only such equipment as actually comes into contact with food. Tin pipe may be manufactured only for the use in the repair or maintenance of beverage dispensing units and parts.

To the prohibited uses, the amended order adds such items as automobile body solder and kitchenware not otherwise provided for.

Paper Work Cut for Aluminum and Magnesium

Washington

• • • **WPB has announced two** new steps in its program to aid industry by cutting down on burdensome reporting. Form WPB-702 (formerly PD-40M), a detailed inventory, consumption, and scrap report required of approximately 300 consumers of magnesium, is no longer required. The reporting of shipments, unfilled orders, and production for aluminum controlled materials (except ingot) on Form WPB-2685 (formerly CMP-24) is curtailed for any company whose shipments amount to less than 2000 lb. in a month. The small company need only notify the Aluminum and Magnesium Division that its shipments were less than 2000 lb. It is estimated that over 40 per cent of those who were reporting will be relieved of the task of preparing the detailed report.



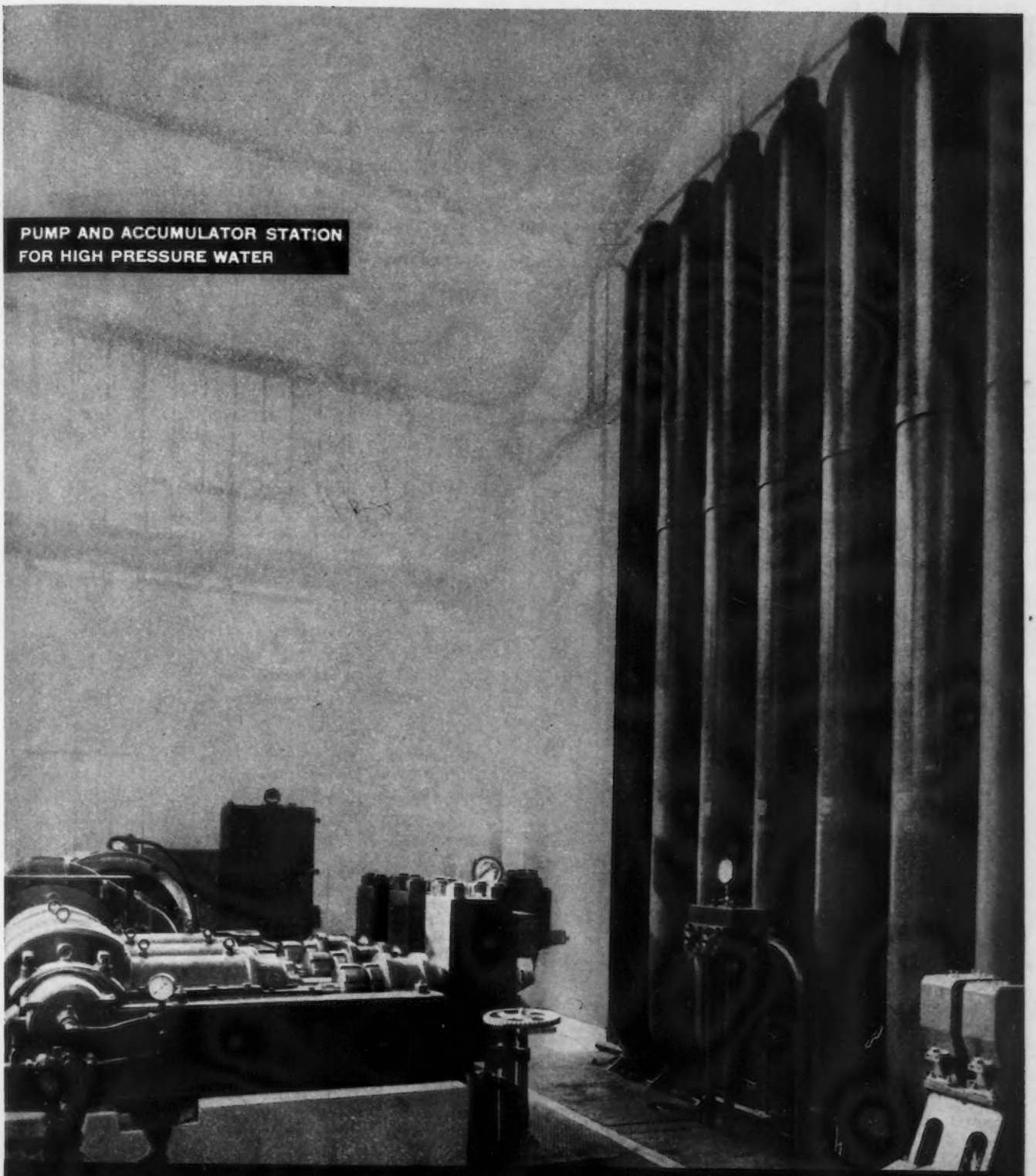
. . . Cited for Awards . . .

• • • **The following companies** have been awarded the Army-Navy "E" for excellence in the production of war materials.

The Bullard Co., Bridgeport, Conn. (third star)
Keokuk Electro-Metals Co., Keokuk, Iowa (renewal)
Jessop Steel Co., Washington, Pa.
Houdaille-Hershey Corp., Oakes Products Div., Chicago
Anderson Tool & Mfg. Co., Chicago
Appalachian Mills Co., Knoxville, Tenn.
Avey Drilling Machine Co., Covington, Ky.
Beloit Iron Works, Beloit, Wis.
Binks Mfg. Co., Chicago
Buffalo Bolt Co., North Tonawanda, N. Y.
Gellman Mfg. Co., Rock Island, Ill.
Landers, Frary & Clark, New Britain, Conn.
Marvin Cary Garage, Cleveland
Mines Equipment Co., St. Louis
Mississippi Foundry Corp., Rock Island, Ill.
Peerless of America, Inc., Marion, Ind.
Read Machinery Co., York, Pa.
Sheet Metal Products, Inc., Newark, Bloomfield and Clifton Plants, N. J.
Stahl-Meyer, Inc., Louis Meyer Plant, Brooklyn
Wiley Machine Co., Los Angeles
York Corporation, York, Pa.

Maritime "M" Commission

Republic Steel Corp., Cleveland
Phelps Dodge Copper Products Corp., Los Angeles Tube Div.



HYDROPRESS · INC.

ENGINEERS CONTRACTORS

HYDRAULIC PRESSES · ROLLING MILLS
PUMPS · ACCUMULATORS

570 LEXINGTON AVENUE · NEW YORK · N. Y.

Fatigue Cracks . . .

BY A. H. DIX

Obstacle Race

• • • Like Gray's plowman, every year we wend our way through the Campbell Memorial Lecture. We don't know whether we can't take it as well as we used to, but this year we found the wending harder than ever. To show how tough a course it is we quote a single sentence from page 58, of your favorite family journal's Oct. 28 issue:

> Crystal No. 5 can be traced to twinning on the second slip plane, whose pole is the filled triangle in the upper left-hand quadrant, by performing the simple rotations corresponding to the assumed condition of strain in its original nucleus, such as a rotation of about 10 deg. around an axis in the slip plane bringing this pole to the nearby position numbered 5; followed by the usual twin-rotations (180 deg. around the pole of the twinning plane) of the other octahedral poles, after their rotation around the first axis, and finally a rotation of some 20 deg. of these three 'twinned' poles around the first.

That's just a sample. We read the whole thing. Must be a masochistic streak in us.

B.V.D. Revealed

• • • We were too quick to accept Clark C. Thompson's explanation that B.V.D. stands for "back vent drawers." Actually it represents the initials of the inventors, Messrs. Bradley, Voorhees and Day.

Beauty in the Personals

> It's a good thing our favorite family journal is not read in movie studios. Otherwise the Ohio Tool Co. would surely lose its director of public relations and advertising.
> —*R. R. Kay*

Miss Schlect's photograph was the brightest spot on our "personal" page this year. Our seismograph shows that reader interest in the page on which it appeared ran clear off the top of the chart.

While we are proud of the job the brains department does with the personals, we do feel that the photographs in that section need pulchritude about as badly as a beri beri sufferer needs vitamin C. But we are not complaining, for the editors are probably doing as well as can be expected, considering the limitations of the material they have to work with.

Dorothie E. Schlect, director of public relations and advertising, Ohio Tool Co., Cleveland.

Nevertheless the deficiency exists, and we hope Miss Schlect's photograph will be set aside to be re-run on the slightest provocation.

Word-Sparing Picture

• • • Speaking of photographs, we noticed that *Life* recently captioned one of a soldier in Sicily, "A laconic soldier . . ." Whoever wrote that should be able to tell the color of a radio performer's hair from the sound of his voice.

Thank You

• • • This is a note of thanks to all members of this page's loyal army of eighteen readers who answered our plea for copies of the Mar. 21 and Apr. 4, 1940, issues. Our files are now complete and we are able to make up a substitute for the January-June, 1940, bound volume, weighing 14 lb. 9 oz., which a visitor absent-mindedly walked off with.

That quipster, Deac, quips:

> The man who stole your January-June 1940 volume did not learn evil habits at mother's knee. Must have been some other joint.

Aptronyms

> The game warden up this way is a Mr. Woodcock.
> —*A. J. Sandorff, Sales Manager, General Abrasive Co., Niagara Falls, N. Y.*

L. B. (Bethlehem Steel) Shapleigh sees significance in the fact that the head of the Collector of Internal Revenue's Audit Section, Cincinnati branch, is Wilbur C. Recher (pronounced "wrecker") and an anonym postcards from Pontiac that Lieut. G. E. Torre, a Navy Price Adjustment Board renegotiator, has the initials GET.

Humble Title That Packs Wallop

> Your item on "clerk" as a rather important corporate title reminds us that the not so old New England mill title of "agent" deserves a philosophical backward glance. As I recall it the agent was the No. 1 man on the local premises and told the mill manager when to open up, when to shut down, and also up.
> —*Harold F. Cotter, University of Alabama*

Apology

• • • On Oct. 21 we stated here:

> "The O'Sullivan rubber heel people are sponsoring Leon Henderson on the radio and are billing the act as "America's No. 1 Heel."

But we were misinformed. John Freiburg, president of O'Sullivan's advertising agency, the Advertising and Sales Council, Inc., of Charles Town, W. Va., writes:

> . . . there is no truth in the statement that we are "billing the act as 'America's No. 1 Heel.' "
> "America's No. 1 Heel" has been the slogan for O'Sullivan Rubber Heels for quite a few years and we use it on the radio as we have used it in all our advertising heretofore . . . there is no attempt to apply the slogan to Mr. Henderson, either in the radio advertising or in any of our other forms.
> The Henderson program is on WJZ, 6:45 every Saturday night. If you have a chance we would certainly appreciate your listening to it.

Our apologies to all concerned, with an extra bow in the direction of Mr. Freiburg for the good-temperedness of his rebuke. If Leon Henderson has no objection to the juxtaposition of his name and O'Sullivan's slogan, our concern is admittedly supererogative.

Puzzles

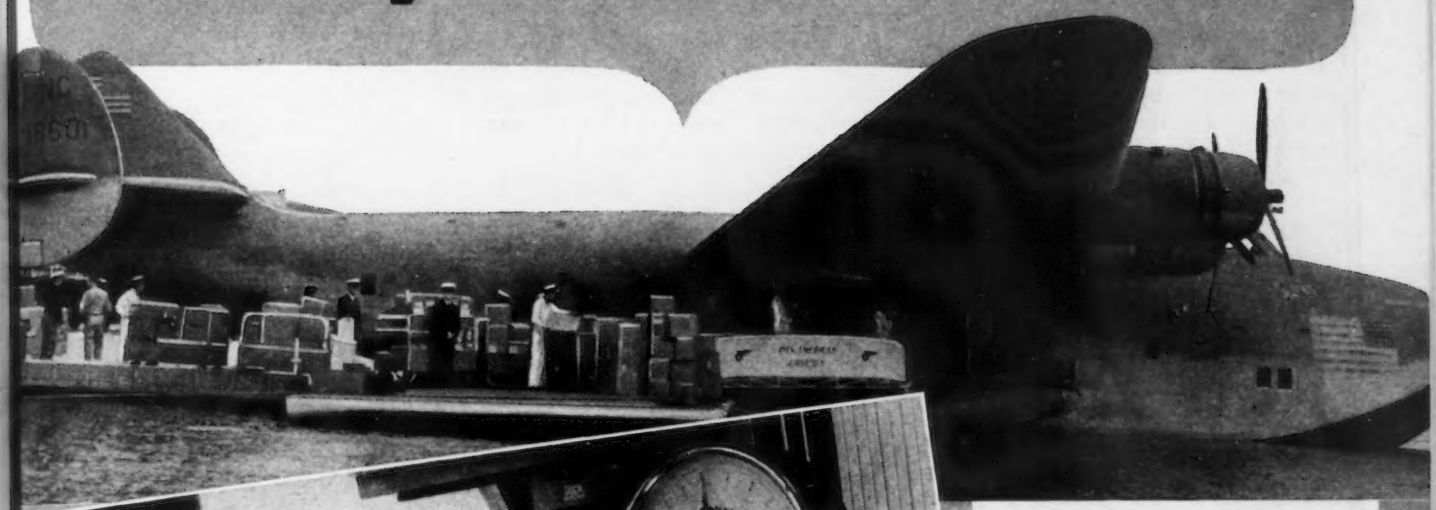
• • • By changing the position of a single match you can make last week's equation an honest one:

$$\sqrt{\text{T}} = 1$$

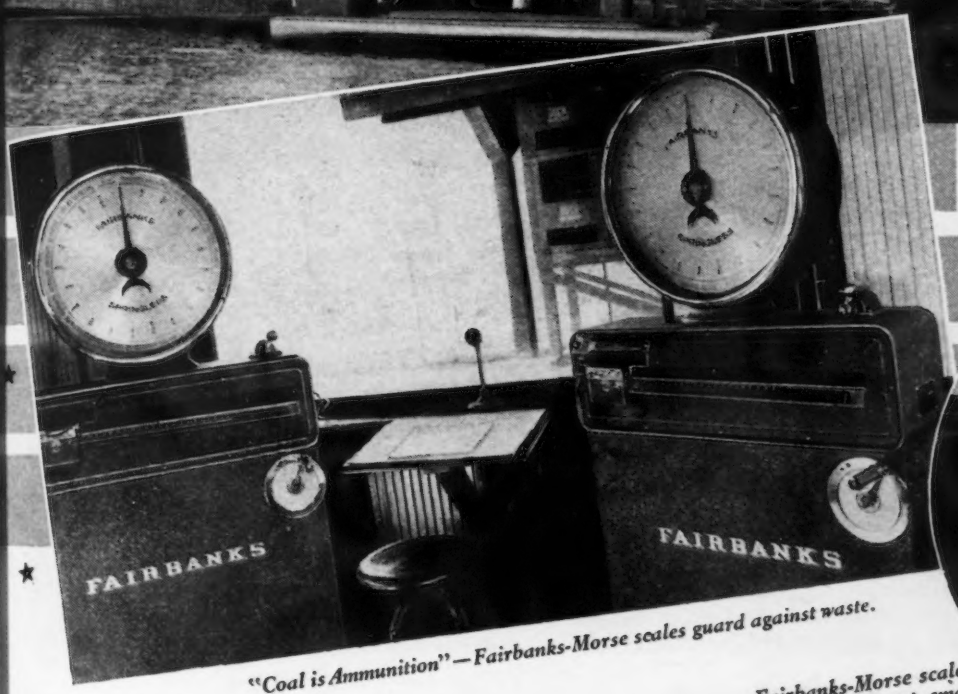
Geo. P. McCracken wants to know how par is established for the problems. Our method is this: if we can solve the problem, we take half our own time as par. If we can't solve it, we guess how long it would take a master mind, and then halve that. For this one par is 12 minutes:

> Three farmers—Reginald, Percival and Joe—went to market with their wives—Monica, Mame and Genevieve—to buy hogs. Each paid as many dollars per hog as the number of hogs he or she bought. Each man spent $63 more than his wife. Monica bought 19 more hogs than Reginald, and Joe bought 23 more than Genevieve. Whose is married to whom.

In Wartime Production . . .
It's *Every Ounce* That Counts!

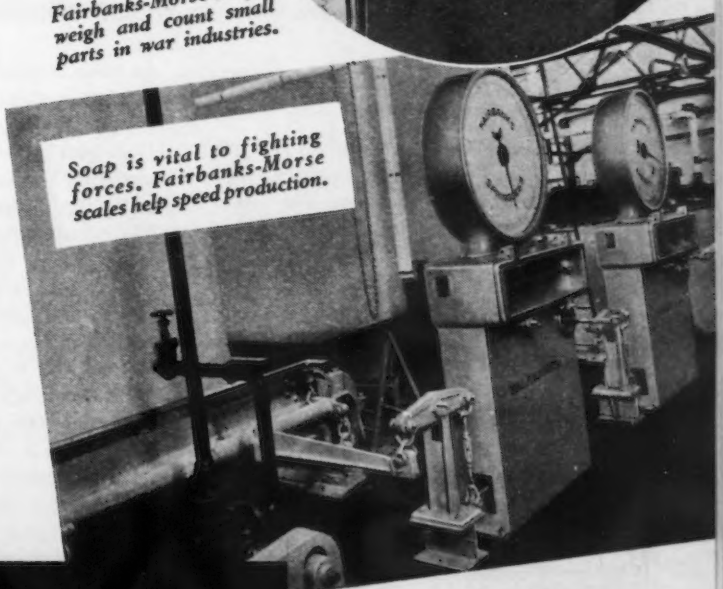


Fairbanks-Morse scales weigh cargo and crew before clipper ships take off for unannounced destinations.



"Coal is Ammunition"—Fairbanks-Morse scales guard against waste.

Fairbanks-Morse scales weigh and count small parts in war industries.



Soap is vital to fighting forces. Fairbanks-Morse scales help speed production.

• OUNCES make pounds and pounds make tons . . . *millions of tons* of wartime production that pass over Fairbanks-Morse scales to help speed the allies to victory.

Food . . . steel . . . munitions . . . chemicals . . . guns . . . tanks . . . textiles . . . *anything and everything* that goes to war must be weighed. It must be weighed accurately . . . quickly—at speeds which human hands can't match, and with accuracy that human eyes can't equal. That's why industry, from the smallest to the largest, finds Fairbanks-Morse scales indispensable in keeping production lines rolling.

If you have weighing problems *now* or if you are *planning ahead* . . . let the Fairbanks-Morse Scale Engineering staff help *you* as it is helping so many others. Write, wire, or phone Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
WATER SYSTEMS
SCALES
STOKERS
FARM EQUIPMENT
RAILROAD EQUIPMENT

Scales

Dear Editor:

TEN-CENT PENNY

Sir:

I can't follow the reasoning of John H. Van Deventer's Nov. 4 editorial that short-changing with the Democratic penny (the one that looks like a dime) has cost the American public $182,000,000. Who got the $182,000,000, anyway?

All the Democratic penny does is redistribute the wealth. Nobody would bother to short-change a customer unless nine cents of illicit profit looked big to him; nobody would be so careless as to allow himself to be short-changed unless he had so much money that nine cents more or less didn't matter to him.

Give the Democratic penny time enough and it will produce a nation in which nobody will be sufficiently hard up to bother with stealing nine cents, and everybody will be so hard up that he will vigilantly watch his change.

A. W. M.

New York

TOOL STEEL DIRECTORY

Sir:

I recently saw a copy of your "Tool Steel Directory" containing a list of tool steels by their trade names and brief descriptions of each. I would like to obtain a copy if you have any on hand and bill me for the cost of the copy.

DAVID J. ASQUITH
Moore Drop Forging Co.,
Springfield, Mass.

● The former edition is out of print, but the new up-to-date edition is now on the press and should be ready in two weeks.—Ed.

FLAME HARDENING

Sir:

We would like very much to get copies of all your issues of October and November, 1940, as we are interested in the series by A. L. Hartley on "Flame Hardening."

JOSEPH M. BENARD
American Locomotive Co.,
Auburn, N. Y.

● This five-part series was reprinted, and a copy is being sent to you.—Ed.

ALIEN PATENTS

Sir:

Please send me a list of enemy owned patents as printed in your July 8 issue.

C. L. SHABINO
Curtiss-Wright Corp.,
Plant No. 2,
Buffalo

● See also the second installment beginning on page 96 of the Nov. 4 issue, and watch coming issues for additional lists.—Ed.

HIGH SPEED MILLING

Sir:

The article "High Speed Milling in Aircraft Production" in your Oct. 14 issue contains information which will be helpful in our work. We are anxious to obtain ten copies.

E. W. HUGHES
Curtiss-Wright Corp.,
Airplane Div.,
Lambert Field,
St. Louis, Mo.

● The article was not reprinted, but we managed to secure eight clippings of it, and are sending them to you.—Ed.

TOOL SALVAGE

Sir:

We are currently emphasizing tool salvage and rehabilitation here, and are trying to keep abreast of latest techniques along these lines. My attention was called to your booklets, "How to Get Maximum Output From Your Cutting Tools" and "How to Make Cutting Tools Last Longer." I would appreciate receiving copies.

F. W. FISHER
Navy Dept.,
Industrial Div.,
Office of Procurement & Material,
Room 1042, K Bldg.,
Washington 25, D. C.

● The 64-page booklet, "How to Get Maximum Output From Your Cutting Tools," is a revised edition of "How to Make Cutting Tools Last Longer." It contains the latest information on tool life lengthening and tool reclamation. The price is 60c.

The 244-page "Salvage Manual for Industry," prepared by the WPB Salvage Division, contains an excellent chapter on reclaiming cutting tools. Copies are obtainable from the Supt. of Documents, Washington, price 50c.—Ed.

WOOD BONDING

Sir:

In your Oct. 28 "Dear Editor" page, you answered an inquiry on a metal to wood bonding process. I was surprised that you did not mention the "Armorply" adhesive which has been specifically designed to meet the peculiar requirements of adhering metal to wood. These can be visualized when you consider that an increase in temperature expands the metal but tends to shrink wood, producing a high stress on the glue line. An increase in humidity does not affect the metal but expands the wood, thus producing another source of glue line stress not commonly experienced.

It is obvious that this art is rather specialized and even "Armorply," which has been developed by the United States Plywood Corp., 616 W. 46th St., New York, has several formulations.

ROBERT S. ARIES
Sargent & Co., Inc.,
New Haven 9, Conn.

QUALITY CONTROL

Sir:

I am interested in publications relating to quality control, and would appreciate it if you would recommend books on this subject. We already have the folders issued by the American Defense Emergency Standards, Z1.1, Z1.2, Z1.3.

W. A. DAWSON
Otis-Fensom Elevator Co., Ltd.,
Ordnance Div.,
Hamilton, Ont.

● The manual on Presentation of Data issued by the American Society of Testing Materials, 260 S. Broad St., Philadelphia, is particularly good. If you wish to delve deeply into the subject, you might purchase "An Engineer's Manual of Statistical Methods," by Simonds, published by John Wiley & Sons, 440 Fourth Ave., New York, or "Economic Control of Manufactured Products," by Shewhard, published by D. Van Nostrand Co., 250 Fourth Ave., New York.—Ed.

JAPAN'S INDUSTRY

Sir:

As a pre-war resident of Japan, I would appreciate it if you would favor me with a copy of "Focal Points in Japan's Industry," published in your April 30 issue.

F. S. THOMAS
Engineering Dept.,
Westinghouse Air Brake Co.,
Box 67,
Wilmerding, Pa.

● Sorry, we have no copies of this issue left. If any reader can spare his copy, will he kindly send it to Mr. Thomas.—Ed.

MACHINABILITY RATINGS

Sir:

We believe that you carried an article in one of your issues on machinability ratings of various steels. Can you tell us what issue?

RICHARD C. PRANIL,
Metallurgical Engineer
American Screw Co.,
Providence, R. I.

● This appeared in the issue of April 1, 1943. For further data, we suggest you address an inquiry to Professor O. W. Boston, University of Michigan, Ann Arbor, Mich.—Ed.

PACK BORING REAMERS

Sir:

Within the last six months, the writer noticed an article in one of the trade magazines in connection with a company down South somewhere that had been very successful in using old fashioned pack boring methods in boring either gun barrels, liner tubes or recoil cylinders, etc.

This article went into quite some detail regarding their method of soaking the maple blocks in oil. . . .

Was this in your magazine? If so, can you furnish tear sheets?

F. R. HIGHT,
Asst. Works Mgr.
Budd Wheel Co.,
Detroit 14

● The article appeared in the July 1943 issue of *Tool Engineer*.—Ed.

the *unusual* in Springs is *not unusual* at Muehlhausen

★ Muehlhausen has provided the answers to many challenging spring problems—provided them at a speed in keeping with war-time demands. Unusual spring requirements have been successfully met with unusual spring designs—made possible by this company's widely varied experience, plus engineering skill and extensive production facilities.

Springs of every shape and size, in quantities large and small, are part of everyday production. Muehlhausen craftsmen are able to produce the correct spring for every requirement—whether a tiny compression spring that will be flexed a hundred times a minute; or a large, hot-formed spring that must withstand extreme operating temperatures.

This ability of Muehlhausen to design and fabricate unusual springs has permitted greater latitude in designing war products now, and will enable engineers to plan, with greater freedom, the products of tomorrow.

MUEHLHAUSEN SPRING CORPORATION
Division of Standard Steel Spring Company
817 Michigan Avenue, Logansport, Indiana

SEND FOR TWO NEW FOLDERS—FREE

New Die Spring Bulletin illustrates, describes 206 sizes and types of die springs.

New Armament Bulletin shows importance of springs for many types of war equipment.

MUEHLHAUSEN
MS
SPRINGS
EVERY TYPE AND SIZE

This Industrial Week . . .

- **Huge Steel Loss, Wage Demands Spring from Strike**
- **Industry in Poor Position to Meet Higher Costs**
- **Ingot Output Gains; Demand for Steel Still Strong**
- **Merchant Pig Iron Situation Now Becoming Easier**

IN addition to the loss of 110,000 tons of steel, the fourth coal strike has set off spiraling wage demands which if granted may bring pressure for higher price levels and cause repercussions through a wide range of industries.

Philip Murray's advance warning this week that the steel union will seek to reopen its contracts brings into the open the unfavorable position of the steel industry in regard to its ability to absorb any sizable wage boost. A 15c. per hour increase would cost the industry $90,000,000 in six months, whereas in the first six months of this year the industry earned only $95,000,000 after taxes. Since January, 1941, the average wage paid per hour per employee in the steel industry has advanced about 34 per cent and raw materials have shown some advance, notably coal. Meanwhile steel prices generally have remained unchanged.

While it is true that a large share of an increase in steel wages would come out of taxes and that a large share of an increase in prices would be borne by taxpayers, the steel industry would be vulnerable after the war tempo slackens and volume drops. Furthermore, steel wages are the bellwether for many other industries which fabricate and utilize steel.

The entire steel price-wage problem will be found by the government to be far more complex than the coal controversy. The latter, however, may not be settled as finally as many persons believe, for the miners are expected by the government to work an extra hour for the wage increase they have received and this may bring friction.

INGOT output this week is recuperating from the effects of the latest mine walkout, but is still hampered by flash strikes such as the one at the Republic Steel Corp. plant in Buffalo, affecting 2500 tons a day. National ingot output this week is up one point to 98 per cent from last week's revised rate of 97. Steel orders have been holding up well, with plate and sheet demand still acute. Revisions in Army, Navy and Maritime demand for war equipment have been numerous but have had little effect upon aggregate backlogs at mills. The Army has placed large orders to offset a Jap surprise in the Pacific. One steel shell case job has been ordered transferred to brass effective Dec. 1 and the cancellation of a bomb casing project provided a little temporary relief at one plate mill. On the other hand landing strip mats are in heavy demand. The ordering of spare parts for the air forces has been cut sharply in recent months. The Navy has overhauled its long range shipbuilding program with regard to certain types of vessels, leading to large scale cancellations of smaller ships intended for construction well in the future. The Navy has shifted considerable work from yard to yard recently. Maritime Commission demand for plates continues high, with a 20,000-ton increase scheduled in the allotment for first quarter, bringing the total allocation to around 1,680,000 tons. Maritime says all ship contract cancellations are being followed by either new contracts or reinstatements.

IN the wake of the significant Truman Committee report on reconversion of industry, the assignment given Bernard M. Baruch to direct economic adjustments is hailed by astute industrialists as one of the most hopeful moves that the Administration has made toward an orderly transformation. No one knows better than he does what a terrific job lies ahead. Mr. Baruch can be expected to receive kinder treatment at the hands of Congress than certain other planners. He is known to favor speed and finality of decision in the termination of war contracts and is likely to advocate that the present war agencies be given the job of unwinding the situations they have created.

AFTER many months of comparatively smooth sailing, the merchant pig iron market is rapidly approaching a point where relaxation of government controls may be a possibility. Reasons include the growth of iron production facilities plus falling demand from foundries that formerly were engaged in machine tool work heavily. The monthly forms which the foundries submitted in some areas last week indicated rather clearly the waning need for iron. Presumably if excess foundry iron piles up it could be used for the making of civilian articles except that foundries are hampered by manpower shortages. This is similar to the situation in aluminum where WPB finally admits production of aluminum is ahead of allotments yet has taken no unusual step to release the aluminum for civilian use presumably because of the lack of manpower which has been perplexing fabricators.

The long delay by the OPA in the promised adjustment of Lake Superior iron ore prices is ascribed

News Highlights in This Issue

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to the necessity for overhauling the lengthy OPA ore price schedule, eliminating reports and giving members of the industry a chance to look over the proposed draft. It appears likely that the industry won't receive the full upward boost it is seeking. Presumably the adjustment will be retroactive. Meanwhile shippers set a new October vessel shipment record of 11,612,542 tons, bringing the total movement for the year to 76,714,837 tons. Thus, the industry will come close to meeting its season quota.

From Canada comes a report that cancellations of war contracts definitely have affected Canadian iron and steel production schedules and at the same time have eased the supply of a number of items on war account and for civilian use. There is little hope that ingot production in the Dominion will reach the hoped-for 1943 goal of 3,000,000 tons. Operations at one plate mill have been cut from two shifts to one shift daily.

IN connection with the one-point rise this week in ingot output to 98 per cent of capacity from last week's revised rate of 97 per cent, Pittsburgh operations increased three points to 98 per cent while Chicago gained one and a half points to 102 per cent. Other gains this week include Cleveland, up one and a half to 98 per cent; Birmingham, up two and a half to 82; Detroit, up half a point to 105 per cent; Cincinnati, up two to 100 per cent and St. Louis, where the Granite City Steel Co. added a new furnace of about 300-ton daily capacity, up half a point to 107 per cent.

Granite City also expects to put in two more open hearth furnaces some time in December. Output in the Wheeling district fell four and a half points to 98 per cent and in the Eastern area, the ingot rate decreased one and a half points to 91.5 per cent. Youngstown at 97, Philadelphia at 93.5 and Buffalo at 104.5 continue unchanged from last week.

THE IRON AGE estimates that the series of mine stoppages which began April 1 and ended this week have cost the nation about 335,000 tons of steel alone. This is a direct loss and does not include the intangible and indirect effects on war production.

Ingots Set Peak; Other News

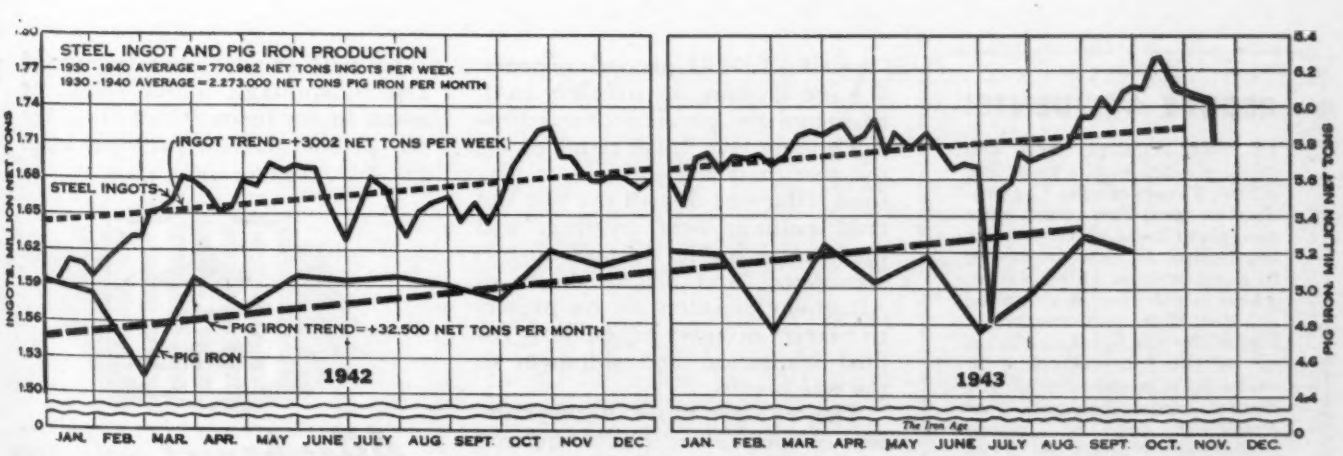
• • • Steel production records were shattered in October when total output reached 7,786,359 tons of ingots and steel for castings, despite some loss of production caused by last month's coal strikes, it was announced Monday by the American Iron and Steel Institute. The October total exceeds by more than 100,000 tons the previous peak of 7,670,187 tons established in March, 1943, largely because of new steel furnaces which have been put into operation since March . . . Use of a higher proportion of scrap in steelmaking to conserve iron ore was urged last week for adoption in the post-war period by Edwin C. Barringer, president of the Institute of Scrap Iron & Steel . . . the Anglo-American Mission reports it now knows how to coordinate U. S. and British Commonwealth steel production . . . WPB's Steel Division has asked all alloy steel melters to increase the percentage of alloy scrap in their charges . . . American Steel & Wire reports production of over five carloads per day of casings for special anti-personnel, fragmentation bombs . . . SWPC, discussing terminations, for the first time brought forward and pleaded for the plight of the small plant if caught without inventory at the war's end.

As previously reported, redistribution activities at the Steel Recovery Corp. are being discontinued and its records transferred to WPB regional offices. A similar procedure has been followed with regard to idle aluminum listed with WPB.

WPB said that since the beginning of the Steel Recovery Program in November, 1942, it has located in idle stocks through this agency alone more than 1,000,000 net tons of steel, of which more than 600,000 tons already have been moved into plants engaged on war or essential civilian contracts. It was stated that it is now felt that the remaining distribution can be handled more expeditiously on a regional basis since the big initial job of utilizing stocks, made idle by conversion to war production has been substantially completed.

Inventory lists of idle steel and aluminum classified for use "as is" have been transferred from SRC to those WPB regional offices in whose areas the material is physically located. Of the more than 46,000,000 lb. of aluminum reported idle only 5,000,000 lb. remain to be redistributed.

The Iron Age


STEEL INGOT AND PIG IRON PRODUCTION
1930 - 1940 AVERAGE = 770,962 NET TONS INGOTS PER WEEK
1930 - 1940 AVERAGE = 2,273,000 NET TONS PIG IRON PER MONTH
INGOT TREND = +3002 NET TONS PER WEEK
STEEL INGOTS
PIG IRON TREND = +32,500 NET TONS PER MONTH
PIG IRON
1942
1943
INGOTS, MILLION NET TONS
PIG IRON, MILLION NET TONS
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
The Iron Age

Steel Ingot Production by Districts and Per Cent of Capacity

Week of	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	West	Ohio River	St. Louis	East	Aggregate
November 4....	95.0*	100.5	97.0*	93.5	96.5	104.5	102.5	79.5*	104.5	95.0	98.0	106.5	93.0	97.0*
November 11...	98.0	102.0	97.0	93.5	98.0	104.5	98.0	82.0	105.0	95.0	100.0	107.0	91.5	98.0

* Revised

O W I Photo by Palmer, in an Allegheny Ludlum Plant

Final Examination

BEFORE STAINLESS GETS ITS WINGS

REDUCE ACCIDENTS!

In 1941, accidents were first cause of death among men from 22 to 38 years of age. The productive man-days lost were enough to build twice as many battleships as now possessed by the combined Allied Navies. These are losses that *can* be avoided. Warn your employees repeatedly not to take risks on or off the job—cooperate in every way possible with the National Safety Council's *War Production Fund to Conserve Manpower,* William A. Irvin, National Chairman, Chrysler Building, New York City.

A GREAT DEAL of costly processing is done on stainless steel, to secure the physical characteristics and surface finish required for the particular war job it is to perform. But one day all the hot and cold rolling, heat treating, and pickling, grinding or polishing is completed, and bright sheets of Allegheny Stainless lie on protective layers of heavy paper, ready for final inspection and shipment to the war plants.

They're *right,* those sheets—flawless of surface and true to desired specifications. Only one essential remains: that they be used as carefully as they were produced—fabricated with an absolute minimum of rejects, spoilage, undue scrap, or waste in any form. ● Call on us for any printed data or personal help.

ADDRESS DEPT. IA-12

AL

STEEL FOR THE NATION'S WELFARE

Allegheny Ludlum

STEEL CORPORATION

BRACKENRIDGE PENNSYLVANIA

A-8823 . . W & D

DOUBLE-DUTY: Steel landing mats are not used only for airfields. Note these in use during the landing of big guns by the Marines from a landing barge at Rendova Island.
Marine Corp Photo courtesy Irving Subway Grating Co.

Lewis Victory Opens Way for Wage Boost Demands from Other Unions; Latest Ingot Loss 110,000 Tons

Pittsburgh

• • • **The ability** of John L. Lewis to accurately gage the supineness of the Administration in the face of labor pressure, and the necessity for mining coal at any cost, won the coal miners an extra $1.50 a day and gave them a contract under government operations which they did not get under private control. This temporary solution has set in action forces which probably will obliterate the "Little Steel" formula and has spurred demands from all other labor groups for additional wage increases. The steel workers' union executive body, meeting at Philadelphia this week, already has formulated plans to reopen steel contracts with the possibility that 15 cents an hour increase might be demanded.

The CIO steel union announced on Monday in Philadelphia that it would lead the way to breaking the "Little Steel" formula and would seek pay increases for most of its 900,000 members. Contracts having the 30-day notice clause are expected to be reopened for negotiation about Dec. 1.

Philip Murray, president of the CIO and USW, declined to admit the gains to be asked but it is known that the international executive committee voted full freedom to the combined unions to start the wage drive.

Mr. Murray handed out copies of the committee's report which said in part, "While wages have been frozen the other portions of the (anti-inflation) program have been ignored, thereby laying the basis for inflation. As a result of this failure it has been the workers solely who have borne the increased burden resulting from these conditions."

A meeting of the union executive board is being called for Nov. 30 to put the drive into action and begin invoking the 30-day clauses on current contracts. The union estimates that 1300 contracts will be reopened.

It was likely, Mr. Murray asserted, that there would be close study at Pittsburgh of the possibility of ending the wage differential granted to Southern steel mills and putting steel wages throughout the country on a basis of "the same pay for the same job."

More serious to the war effort, however, than the inflationary tendencies set off by the coal settlement, was the irretrievable loss for the fourth coal

strike of about 110,000 tons of steel ingots. The series of mine stoppages, which began on April 1, have cost the nation about 335,000 tons of steel. This is a direct loss, however, and does not indicate the intangible and indirect effects on war production.

Alongside this tremendous loss in steel output must be placed such items as depletion of strategic war materials, mechanical effects on steel equipment due to the numerous necessary slowdowns and shutdowns, increased steelmaking costs due to coal allocations, substantial losses in steel wages due to blast furnace and open hearth shutdowns, and the placing of the steel industry in a precarious position coal and coke-wise with respect to future emergencies such as the early closing of inland navigation.

If the contract which the government and Mr. Lewis will sign means what it says, that miners must work an additional productive hour to get the $1.50 a day, then theoretically the War Labor Board has not violated the "Little Steel" formula. However, practically everybody in the country except the WLB apparently believes the miners will continue to work as they have worked, but will receive $1.50 more a day.

If what the WLB says in insisting that the miners' raise is proper under the old contract, because of increased working time, is correct, then the series of paralyzing strikes since last April and the government seizure of mines represent one of the greatest industrial losses for no apparent reason, except politics, that the country has faced in either war or peacetime.

On the other hand, if the coal contract means what most observers here believe it to mean, that coal production will not be increased materially, and that coal miners will receive an extra $1.50 a day for approximately the same number of hours of work, then the country faces the possibility of industrial stoppages in other fields aside from coal.

It is estimated here that the increase in coal costs will run from 50 to 52 cents a ton, which the consumer is expected to carry. However, in the case of steel companies, whose prices have been frozen by the OPA, the increased cost at captive mines must be absorbed unless the lid is taken off steel prices to some extent. A knockdown drag-out battle with OPA would be necessary before any such adjustment could be made.

Foreshadowing the seriousness of the steel price situation, however, is the possibility that Philip Murray's steel union may eventually obtain

Courtesy Pittsburgh Post-Gazette

wage rate concessions from the WLB. Practically any increase in basic steel wages on top of increased coal cost would force the steel industry to call for a showdown with OPA on its steel price structure.

Hourly wage costs of the steel industry have gone up more than 77 per cent since January, 1936, and since January, 1941, are up slightly more than 34 per cent. It seems clear to observers here that the next several months will see the steel industry and the United Steel Workers of America at loggerheads over higher steel wages. Before any clear-cut decision is reached, this problem may result in a definite and final showdown, involving the CIO, the steel industry, the OPA, and finally the White House.

•

Birmingham

• • • **As of last Saturday,** Alabama has lost approximately 51,000 tons of steel ingots and 91,000 tons of iron as a result of the coal mine strike that started in this state on Oct. 13. The bituminous coal loss in Alabama is over the 1,000,000-ton mark.

It seemed likely that mine production would pick up this week. No actual shutdown of Alabama plants producing finished articles has been reported but there has been a tremendous drain on their fuel stockpiles and many shutdowns are imminent if relief is not forthcoming. Most, if not all, of these shutdowns probably can be averted if the miners return to work promptly.

Approximately 15,000 of Alabama's 22,000 union coal miners returned to work Monday. The Tennessee company has been able to keep in production its finishing units at Ensley steel works.

Other Strikes Numerous

• • • **A new flare-up of** unauthorized strikes started to take its toll of war production last week.

Hundreds of tons of steel per day were bottlenecked in the open hearths of Republic Steel Corp.'s plant in Buffalo last Thursday when about 375 blooming mill workers walked out protesting working conditions which have existed for years according to a company spokesman. Between 1500 and 1800 workers were thrown into idleness and eight open hearth furnaces were banked. One of the company's blast furnaces was still reported operating on Monday.

War production stopped last Tuesday at the Ambridge, Pa., Spang-Chalfant division plant of the National Supply Co. when 3000 workers struck protesting the disciplinary dismissal of a worker. Promise of arbitration of the dismissed worker's case had workers ready to return Monday night.

Ford Motor Co. foundry employees numbering about 7000 were reported returning to work on Monday following a walkout at the Rouge plant last week said to have been caused by a dispute between a foreman and a worker.

The General Motors Buick division foundry was reported ready to return to operation on Tuesday after 3300 workers that had walked out last Thursday disputing two disciplinary suspensions were ordered back by UAW-CIO leaders.

Tuesday was slated as the return to work day for workers of the Phelps Dodge Corp. copper mines at Morenci, Ariz. The employees walked off the job last Friday, seven days after an employees committee had presented a proposal asking 26c. per day pay increase. WLB's promise to consider the request was credited with bringing the workers back on the job.

Loans of Controlled Materials Clarified by WPB

Washington

• • • **WPB has issued** Interpretation 21 to CMP Reg. 1, defining the limitations that must be placed on the loan of controlled materials or Class A products to another manufacturer for his use in filling an authorized production schedule. The contractor must make certain that the material loaned will be returned to him when he needs it and must make sure that lending the material will not prevent fulfillment of his own production schedules.

Establish Standards Now For Reconversion, Senate Committee Urges

By DONALD BROWNE
Washington Bureau

Washington

• • • **In the most conservative commonsense report issued during the war by a branch of the government, the Truman Senate Committee last Friday called upon Congress to make it as painless as possible for industry to reconvert.**

Realizing the confusion now facing all war producers, the Committee said that the government must establish "standards by which business is to operate in such a way that business men will know where they stand, what they can do, and what they cannot do."

The Committee also advised the executive agencies that it would be a futile task to try to tell industry what products are to be made, by whom, in what quantity, and when, because of the previous failures of government industrial planning.

The determinations helpful to business which government must make, the report said, are: (1) Contract termination methods after the war; (2) how much advance notice industry can have of termination; (3) the methods for insuring the early removal of government property from private plants to ready the plants for civilian production; (4) the extent to which the government will make or guarantee loans to provide working capital, and (5) lease or sale conditions under which government will dispose of war plants and facilities.

The Committee's further recommendations were:

Contract cancellation—It should be abrupt as soon as the war ends. During the war contractors should be notified as far ahead as possible as soon as the high command decides to slash a military program. Obvious reasons are the saving of public money, manpower and materials, and protection of civilian markets from over-flooding with surplus war goods. Substantial guaranteed government loans through private banks to contractors whose accounts against the government are in dispute.

Demobilization—WPB should allocate materials for mid-war conversion as soon as war plants, materials and labor can be spared from military production.

There should be no post-war WPA for soldiers and sailors through retaining them in the armed services until business firms can rehire them —"such suggestions are beyond the authority of the War Department."

Inventories—From now on contractors should strive to keep inventories at a minimum. The time has come to stop war-scare material purchases so companies won't have so much invested capital tied up. War producers with CMP-60-day inventories will be better banking risks because they are more liquid.

The report quoted WPB Statistical Division inaccurate figures on steel inventories which reported them to be about 8,500,000 tons on June 30. Steel Division officials say this figure is wrong and apparently does not include work in process and steel held by mills and warehouses.

Work in process and uncut inventory probably amounts to an estimated 15,000,000 to 20,000,000 tons now, giving all consumers about a four months average supply. Stocks in June were probably higher. An additional 2,000,000 to 5,000,000 tons should be included in the computation as being owned by mills and warehouses.

Surpluses—A War Surplus Corp. should be created to administer uniform policies to be formulated. It should be a civilian undertaking.

Finance—A 20 per cent post-war reserve as a deduction from taxable income should be legislated. The reserve should be kept by the government in form of special issue of bonds which upon liquidation would have to be taxed in the year of cashing in.

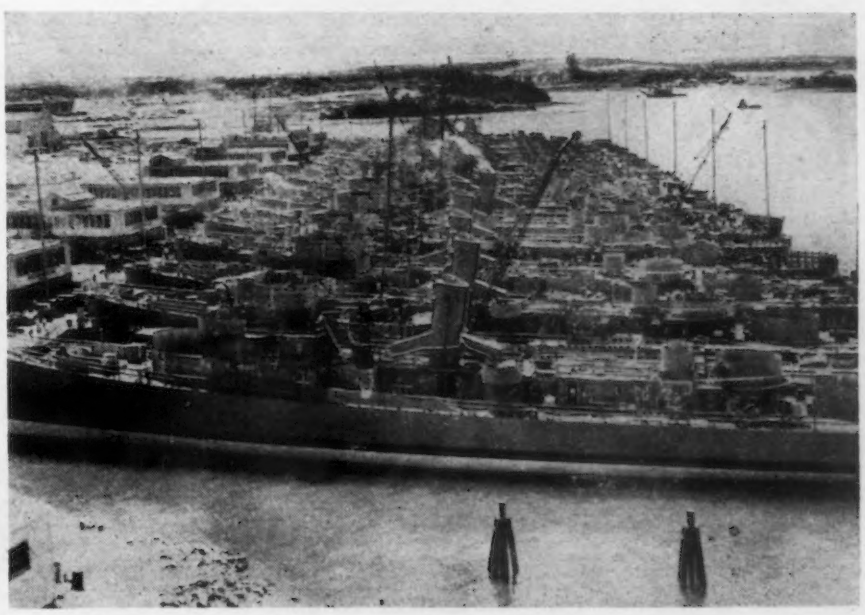
Private banks should finance conversion so far as possible. RFC funds should be made available for direct loans where bank won't take the risk. Government should not be permitted to use loaning power as a club over head of industry to regulate it or to threaten with competition.

Plants—Government must recognize that the value of war facilities is not its cost to the government because of higher wartime construction costs, and added reconversion costs to purchasers of specially designed munitions plants make imperative realistic offering prices to industry. However, plants should not be given away or leased or sold in a manner to create unfair competitive advantages.

Purchase lease agreements with rentals applying to sale price must be good method of getting rid of the plants. Or, after valuation by the government for peacetime uses, the plant could be sold under an arrangement whereby the company would pay for it over its useful lifetime, by annual payments equal to the amortization plus interest on the unpaid balance.

Labor—"Business must be fair to

READY TO GO: Here is a whole row of new destroyer escort vessels being fitted out for the Navy at the Bethlehem-Hingham shipyard. Power plants for these speedy vessels, two turbine-electric units each, designed by General Electric, will drive them fast enough to overtake any submarine afloat, the company reports.



labor and labor will have to take a realistic view of the situation. Specifically, it must understand the importance to labor of stabilizing working conditions in a manner that will permit increased production and a widespread distribution to labor of the articles produced.

"In wartime, additional labor costs are absorbed by the government. In peacetime, they have to be taken out of profits or added to prices. Many industries will not have a sufficient profit margin and will not be able to increase prices and still sell their products in competition with other products filling similar wants. A demand for too much in such an industry would result in closing the plants.

"Much will depend upon the courage and ability of leadership in labor. Labor leaders will find it difficult to walk the tightrope of getting the best terms possible for their members, and at the same time take a realistic approach to hard facts."

Baruch Favors Speedy Termination Policy

By DON JAMES
News and Markets Editor

New York

• • • **In the wake of** the appointment of Bernard M. Baruch to direct postwar economic adjustments, it is likely that present war agencies will be given the job of unwinding the situations that they have created. For example, WPB with its CMP plan and its industrial committees, working in unison with other departments, will be one of the key agencies in the turn from war to peace.

The assignment given Mr. Baruch is interpreted by some astute industrialists as one of the most hopeful moves that the Administration has made toward an orderly transformation and toward the control of bureaucracies. No one knows better than he does what a terrific job lies ahead in the face of what he considers faulty industrial mobilization and inflation. Yet he can be counted upon to go ahead and do his best with a bad situation, and to give business a fair break.

Questions of policy in regard to the termination of war contracts will be among Mr. Baruch's most immediate problems. He is known to favor speed and finality of decision (which the Army and Navy have been urging) in the termination of war contracts, but not so speedily as to permit frauds against the government.

Mr. Baruch already has pitched into his job at full tilt, and sooner or later will have prepared a report covering all the numerous ramifications. It can be expected that in many respects the ideas which the Truman Committee has expressed, as outlined in the story above, will be paralleled by the Baruch report.

Other highlights of the past week include:

The filing of a suit by Lincoln Electric Co. challenging the constitutionality of the contract renegotiation act. The company asked an injunction to prevent the government from enforcing a claim for $3,250,000 which a price adjustment board said represented excessive profits on contracts in 1942. A Navy price adjustment board served notice that contract payments would be held up unless the company turned over the $3,250,000.

Report by the House Small Business Committee urging that a central agency be set up to handle Government surpluses.

Release by the American Gear Manufacturers' Association of the text of a telegram which was sent to Rep. A. J. May, chairman of the Military Affairs Committee, and B. M. Gross, chief of research and hearings, Senate Office Building: "On Oct. 27 at our semi-annual convention, representing practically all independent gear manufacturers in U. S. A., a resolution was unanimously passed recommending that Congress enact contract termination legislation favorable to the following: First, single overall claim by company or plant. Second, mandatory advance cash settlement at least 75 per cent of certified claim. Third, separate the disposition of inventory from settlement of claim. Fourth, creation of central contract termination board."

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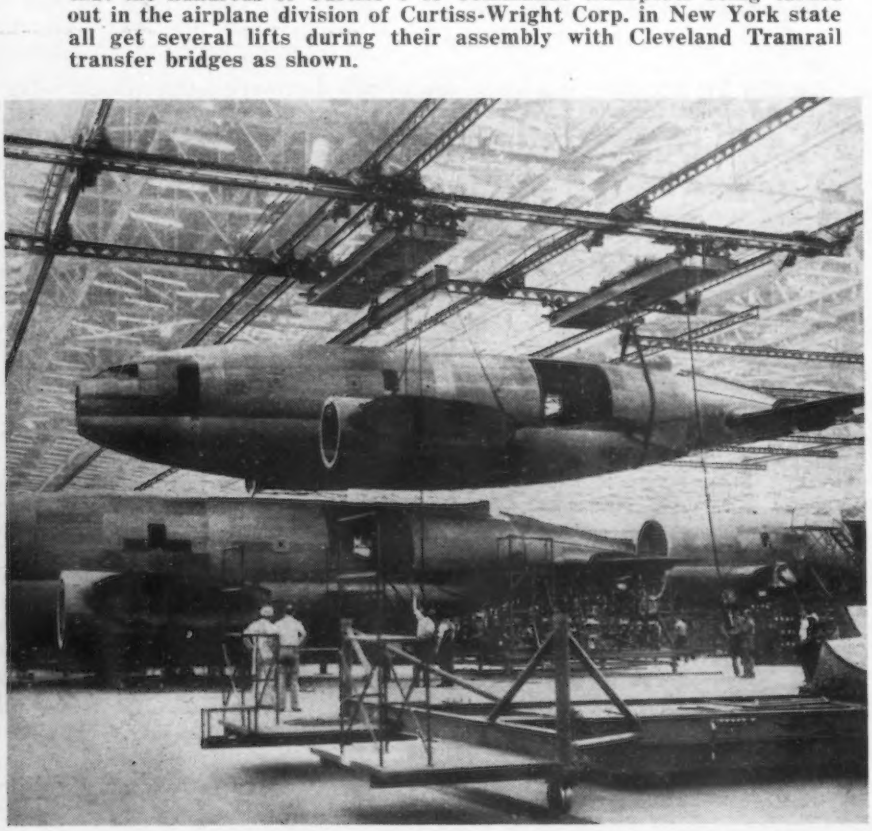
Washington

• • • **OWM's** new super-planning unit, headed since last Saturday by Bernard M. Baruch, can be expected to receive kinder treatment at the hands of Congress than the defunct National Resources Planning Board. Congress killed NRPB.

COMMANDOS GET A BOOST: Cleveland Crane & Engineering Co. reports that the hundreds of Curtiss C-45 Commando transports being turned out in the airplane division of Curtiss-Wright Corp. in New York state all get several lifts during their assembly with Cleveland Tramrail transfer bridges as shown.



Assisting Your Search for New Ideas—

Here's Another Installment of Seized Patents

• • • **Are you** glancing at the lists of confiscated patents as they appear in THE IRON AGE? Their publication is an unparalleled service for metalworking firms, large and small, desirous of obtaining new ideas.

For a comparatively small fee (you must have a license) it is possible for a company to obtain the right to use a desired patent which has been shorn of its protection by the U. S. Government because of the war. Any firm, small or large, may obtain the right to employ the patent even though many others are using it.

Last week in the news section on page 95 there appeared a full explanation of how to proceed in the event patents of potential value are noted. Also in the same issue there appeared Class 205, Metal Drawing; Class 185, Motors; Class 7, Compound Tools, and a start on Class 22, Metal Founding. This week Class 22 is completed below and a start is given on Class 153, Metal Bending. On July 8 this magazine printed lists of hundreds of seized patent applications believed open for licensing on the same basis as the patents.

Obtaining a reasonably concise description of each patent has been no easy task. The accuracy of the various items cannot be guaranteed but they all are believed reasonably correct.

In each item listed, the sub-class number appears first, in parenthesis; followed by the patent number, the description, the inventor's name, his nation and the date the patent was granted.

Post-War Implications

The right to use patents which the United States Government has seized from inventors of enemy nations extends into the post-war period. The license which any U. S. firm, large or small, may obtain for a comparatively low fee, is granted by the Alien Property Custodian for the full life of the patent. Thus, if the life of the patent extends for seven years and the war ends in two years, at least five years' use of the patent may be made beyond the end of the war. This pertains to enemy patents, those seized from Germany and Japan for example.

In the case of patents seized from inventors in enemy-occupied nations (such as Belgium, Holland, etc.) a different procedure exists. The license is granted by the Alien Property Custodian to the end of the war and for six months thereafter. For still further use of the patent beyond the six months after the end of the war, the licensed firm must agree to pay a reasonable royalty. The royalty arrangement can be agreed upon now, or it can be fixed after the war is over, or the licensed firm can drop the license after the war ends if it so desires. In other words, the enemy-occupied patents may be used without a royalty during the war and for six months after the war, but then if the licensed firm desires to continue using the patent it may do so by paying a royalty.

During the war no special fees, percentage payments or royalties are applicable beyond the initial fee. (See THE IRON AGE, Nov. 4, pages 95 and 96, for full details covering the initial fee.)

A word about the classification of patents may be valuable to readers. The classification being followed is the U. S. Patent Office classification, developed over the past 35 years and claimed by experts to be the best possible classification, although it still is undergoing changes. This classification is on the basis of the actual invention which is claimed by the inventor.

Certain subjects will not be found classified separately. In such cases it will be necessary to examine numerous classes. "Metal Stamping" appears to be one of these classes not listed under their own labels. An interested firm would have to look under the headings of various classes of products.

It is understood by THE IRON AGE that each seized patent or seized patent application (there are over 50,000 of them) is listed only once by the APC.

Class 22—Metal Founding—Continued

(65) 2,008,196. Centrifugal casting machine for use in the production of cylindrical or conical metal bodies. Karl Weber, Germany. 7-16-35.

(65) 2,026,457. Apparatus and method for making centrifugal castings whereby the molten material from which the casting is made is forced into the form or die by centrifugal force. Hans Breitbart, Germany. 12-31-35.

(65) 2,034,692. Apparatus for making certrifugal castings for the production of hollow bodies of an even thickness of wall. Hans Breitbart, Germany. 3-24-36.

(65) 2,130,726. Molds for casting tubes of iron and other metallic materials. R. Ardelt, Germany. 9-20-38.

(65) 2,148,802. Apparatus for the manufacture of centrifugally cast pipes. Max Bunke, Germany. 2-28-39.

(65) 2,159,073. Molding machine and mold for the centrifugal casting of thin annular plates of metal which are intended to be cut into strips and then to be worked into wire. W. Bremicker, Germany. 5-23-39.

(65) 2,208,368. Device for the mass production of semi-manufactures, such as bars or the like, by centrifugal casting. Julius Hauck, Austria. 7-16-40.

(65) 2,214,133. Apparatus for commercial mass production of semi-manufactures, such as bars or the like, by centrifugal casting. Julius Hauck, Austria. 9-10-40.

(65) 2,230,514. Apparatus for the production of castings. Georg Pemetzrieder, Germany. 2-4-41.

(65.10) 1,727,518. Casting apparatus for the complete filling up of casting molds without any loss of material and the attaining of a homogeneity of certain alloys of gold in the direct casting process. Richard Oettinger, Germany. 9-10-29.

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(65.10) 2,006,148. Muffle for use in connection with casting of precious metals. K. Plaschka, Austria. 6-25-35.

(65.10) 2,009,489. Centrifugal casting apparatus for dental purposes. C. Fritzsche, Germany. 7-30-35.

(67) 1,673,054. Apparatus for casting metal, with application of pressure to the casting in the mold. Paul Rosenberger, Germany. 6-12-28.

(67) 1,698,441. Device for casting metal in molds. Robert Kolb, Germany. 1-8-29.

(67) 1,888,913. Mold for casting metals and metal

(Continued on Page 114)

Expansion Removes Aluminum from Strictly Critical List; Some Items Short

New York

• • • **A prodigious wartime** expansion of production and fabrication facilities, assistance from Canadian interests, adequate and carefully observed scrap reclamation methods, diversion of specifications and a considerable amount of ingenuity have finally removed aluminum and magnesium from the list of strictly critical wartime metals. Not only is aluminum meeting the vastly expanded war production requirements but it now is ready to meet other needs and even pinch-hit for other strategic materials.

Evidence that aluminum is easier can be seen in the pushing forward of Russia's fourth quarter allotments to third quarter schedules, the diversion to Great Britain of 180,000,000 lb. of Canadian aluminum scheduled for delivery to the United States during 1944 and the substantial lead aluminum supply holds over allotments, according to A. H. Bunker, director of the aluminum and magnesium division of WPB.

The reasons allotments are rising more slowly than supply are because aircraft requirements are getting a more careful screening on bills of materials; more experienced and more conservative estimates of requirements are being made by the claimant agencies; allocations are being trimmed to match processing capacity, such as in the case of hammer forgings and extrusions. (See chart of supply estimates and allotments below.)

All of the production and progress cannot be credited to the United States, however. Canada, through the Aluminum Co. of Canada, has delivered 500,000,000 lb. of aluminum up to September of this year. The year 1944 would have netted another 180,000,000 lb. from this source if diversion was not possible because of a plentiful supply of home product.

Salvaging of aluminum scrap, a process which has been carefully planned and closely followed, is returning about 700,000,000 lb. of aluminum per year, twice the total prewar primary aluminum production. This salvage is also saving critical alloying components such as copper and manganese.

Scrap segregation by aluminum consumers has been carried out very thoroughly. About 90 per cent of all aluminum scrap is now said to be segregated as compared with about 30 per cent two years ago. Turnover of scrap in dealers yards is expected to reach 10,000,000 lb. every two months soon.

A good part of the easing supply situation is being realized through the greater acceptance of secondary aluminum in military and essential contract specifications which allows the total supply to be enlarged by the scrap that can be salvaged in addition to the increased production of primary aluminum.

The Aluminum Division of WPB has encouraged the Army and Navy to utilize secondary aluminum in such items as gun director parts and many other non-critical uses, the steel industry has been permitted to increase amounts for deoxidizing purposes (killed heats), Russia has agreed to take one-third of its fourth quarter allotment in secondary, and an effort is being made to revise all possible specifications to utilize this now plentiful grade.

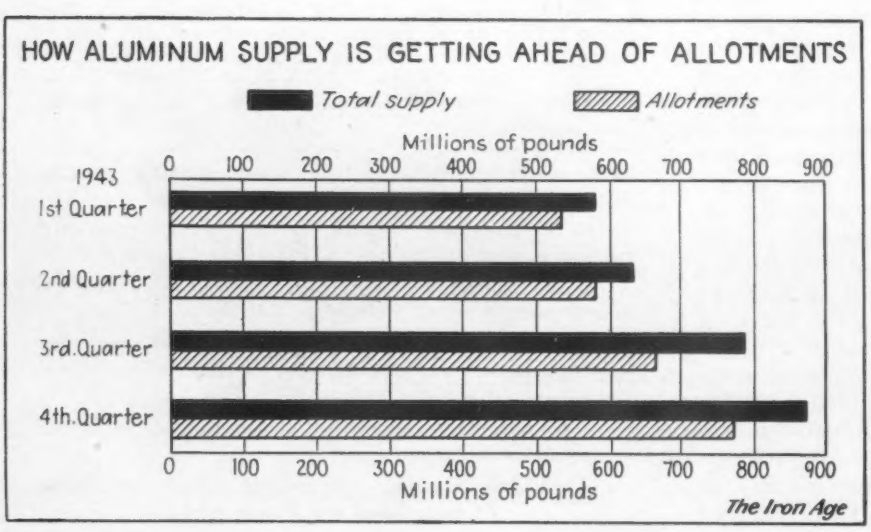
The fact, however, that there is now enough primary and secondary aluminum does not mean that it is available in adequate quantities in all required shapes. Bottlenecks still exist. Tube blooms which require time on extrusion presses have reduced the output of extrusions, rod demand is below production capacity, production difficulties, labor and rejections have held castings below demand levels, hammer forgings are also short.

To overcome these bottlenecks, capacity is being increased for forgings and extrusions, small rod output will be increased by using extrusion presses formerly employed making tubing and lower specifications may increase casting output.

Further evidence of the greater freedom in the availability of aluminum can be seen in the recent WPB amendment to Conservation Order M-1-i which released aluminum for many new uses in machines, tools and other home front equipment serving the war effort. The order also presents aluminum as a substitute for certain critical materials such as copper, in specific uses, reflecting the relative degree of necessity of the two metals.

Magnesium, while not reported in the same degree of plenty recorded for aluminum, has been the object of great ingenuity and invention which has substantially increased its availability. A new method of magnesium reduction using ferro-silicon as a reduction agent, has improved and cheapened production. New methods involving the use of low grade bauxite and other low grade aluminum ores have also been brought into use to conserve our native high grade deposits.

Typical of the tremendous expansion project required to bring these light metals into sufficient supply are the facts that more than a billion dollars was expended, bauxite production was increased 12 times over 1939 levels, tubing increased 13 times; sheets 7 times; rod and wire 12 times; extruded shapes 10 times and forgings 45 times. Raw materials which had to be supplied included: petroleum coke 200,000 tons; soda ash 500,000 tons; sulphuric acid 60,000 tons;



filter cloth 1,500,000 yards plus 30-billion kw. of electric power. Employment had to be increased from 30,000 workers to 200,000 in that period and the last half of 1943 still requires over 147,000 hirings to produce about 67,000 additional workers in the industries.

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Aluminum is Canadian Post-War Problem

Ottawa

• • • **Addressing the Parliamentary** Committee on aluminum, George C. Bateman, Metals Controller, stated that Canada has reached a point where she must give very serious thought to what is going to happen to her mining and metals industries after the war. Mr. Bateman said:

"With the completion of the war there is no program that will be cut as quickly as airplane production. So that at the end of the war we will have a tremendous aluminum capacity in Canada, about 12 times that of pre-war capacity, which not only will have to try to find new outlets in competition with other metals and other materials, but also will have to face the competition of great tonnages of scrap.

"In about five days at present rate of production we could fill all the probable annual requirements for post-war airplane production."

The Metals Controller made special reference to the various competitive materials which aluminum would have to face in the post-war world. He emphasized that the determining factor in each case was not the cost per pound of the primary metal or material, but the ultimate cost of the finished article. He continued:

"The cost of the raw material is a relatively minor part of the cost of the finished product, so what has to be considered is the ultimate cost, and that includes the cost of aluminum and the cost of fabricating the aluminum and the cost of production in using these fabricated parts. This is a matter to which I have given a good deal of thought and regarding which I am very concerned because my business, my life, has been spent with the mining industry and I see a lot of trouble ahead of it.

"While these problems will apply with force to all of the primary non-ferrous metals and minerals (aluminum, copper, lead, zinc and nickel) they probably will apply to a much greater extent to aluminum because of the fact that aluminum capacity has been expanded to a much greater extent than that of any other metal. And that expansion has been almost entirely to meet the needs of the airplane program.

"I am a firm believer that we are entering the age of light alloys, but under today's conditions of technological advances you have to revise your conception of what constitutes a light alloy. I expect aluminum to continue as one of our great Canadian industries. I expect to see it expand in post-war markets, but I also believe that any great expansion above the pre-war markets is going to represent a very difficult time or condition and can only be attained at the expenditure of a great deal of money carried on over a period of a good many years."

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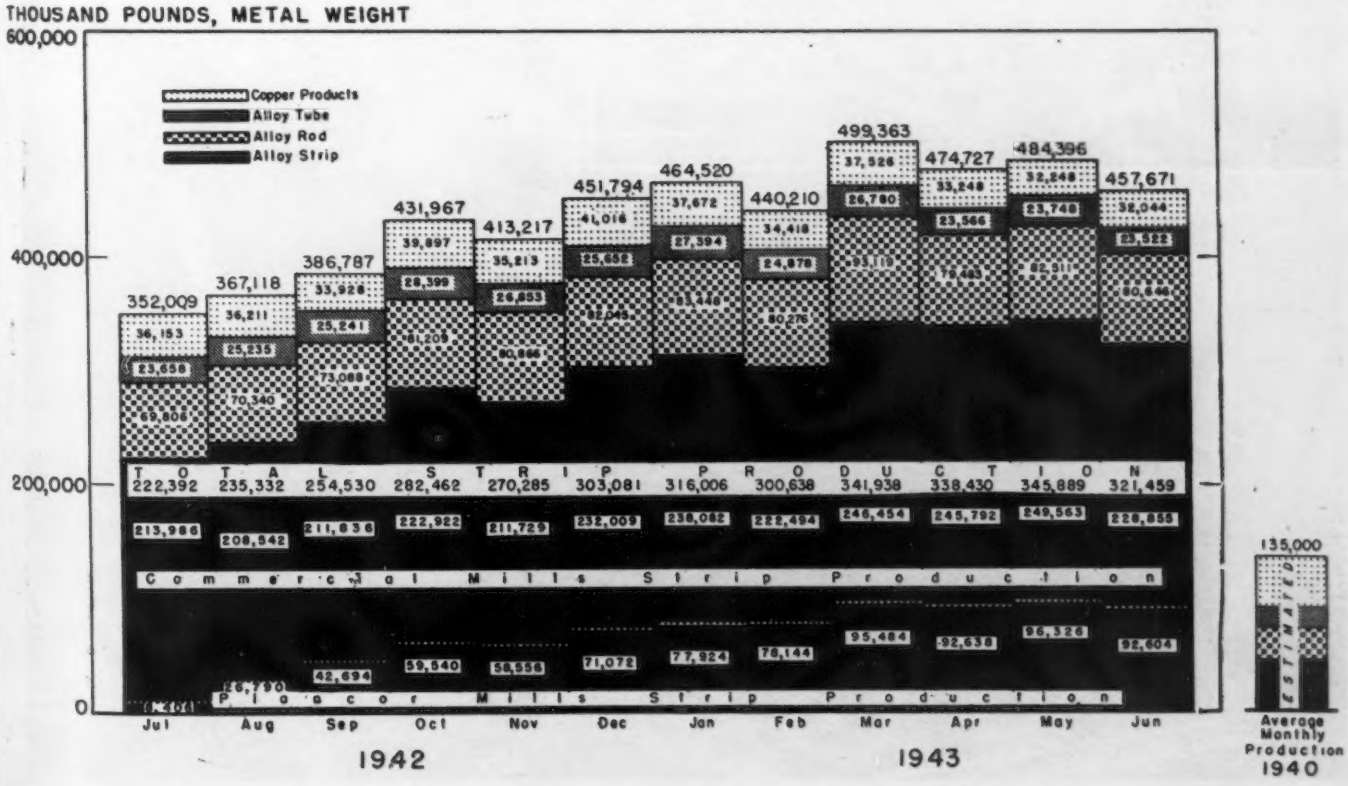
New York

• • • **The Aluminum Co. of America** announced Nov. 5 the private sale of $84,000,000 in 20 year, three per cent debentures to 16 insurance companies through the Mellon Securities Corp. The major portion of the proceeds are expected to retire bank loans, the company said.

PRIMARY BRASS MILL PRODUCTION: This chart was issued recently by the WPB Copper Division and shows primary brass mill output by type of product.



One-Fourth of Steel Going to Home Front

New York

• • • **About one-fourth** of the current record-breaking output of steel is allocated for purposes other than the primary production of goods used directly or indirectly for war, according to the American Iron and Steel Institute.

This class includes shipments to the petroleum and mining industries, the public utilities and railroads, the farm market, and container makers. In 1940, those industries consumed nearly 40 per cent of the steel then produced.

Shipments of steel to all consumers are averaging about 5,000,000 tons per month. Of that total, an average of about 1,250,000 tons per month is currently used to maintain the efficiency of industry and the public.

So far this year, the railroads have received an average of 355,000 tons per month, while 305,000 tons per month have gone to container manufacturers, says the Institute. Steel plants have exchanged among themselves nearly 155,000 tons of semi-finished steel per month and have in addition consumed perhaps 100,000 tons more per month for maintenance and repairs.

The petroleum and mining industries together have been receiving about 130,000 tons of steel monthly. Construction projects of the railways and public utilities have used 22,000 tons per month, and another 20,000 tons per month have gone for public and highway construction.

About 40,000 tons of steel per month have been going to the farm market this year for farm implements, fencing, etc., and 35,000 tons have gone monthly to makers of home and office furniture and hardware. About 85,000 tons per month have been taken by miscellaneous industries.

Land Denies Rumors of Decline in Shipyard Backlogs

Washington

• • • **Admiral** Emory S. Land last Thursday denied that any contract cancellations have been made which have not resulted in reinstatement of previous contracts or new contracts for merchant shipbuilding.

Persistent rumors that the Maritime Commission has canceled substantial shipping tonnage were explained by the Maritime Chairman as shifts occurring from month to month in the program.

West Coast shipyards have experienced cancellations but new contracts call for Victories, C-2's and national tankers, he said. Bethlehem-Fairfield at Baltimore is converting to Victory ship production. The Walsh-Kaiser yard at Providence, R. I., whose original contracts were for Liberties, was recently shifted to Frigates and another contract change order put the yard to work producing a special type of ship for the Navy.

HALF CENTURY ENDS WITH RECORD: An all-time high mark for ingot production by Inland Steel Co. was announced last week as the company celebrated its 50th anniversary. The record was set in October when the Indiana Harbor plant produced 2738 net tons more than in the previous high month, last March. Photos below show the modest beginning of the company and its present impressive plant facilities.

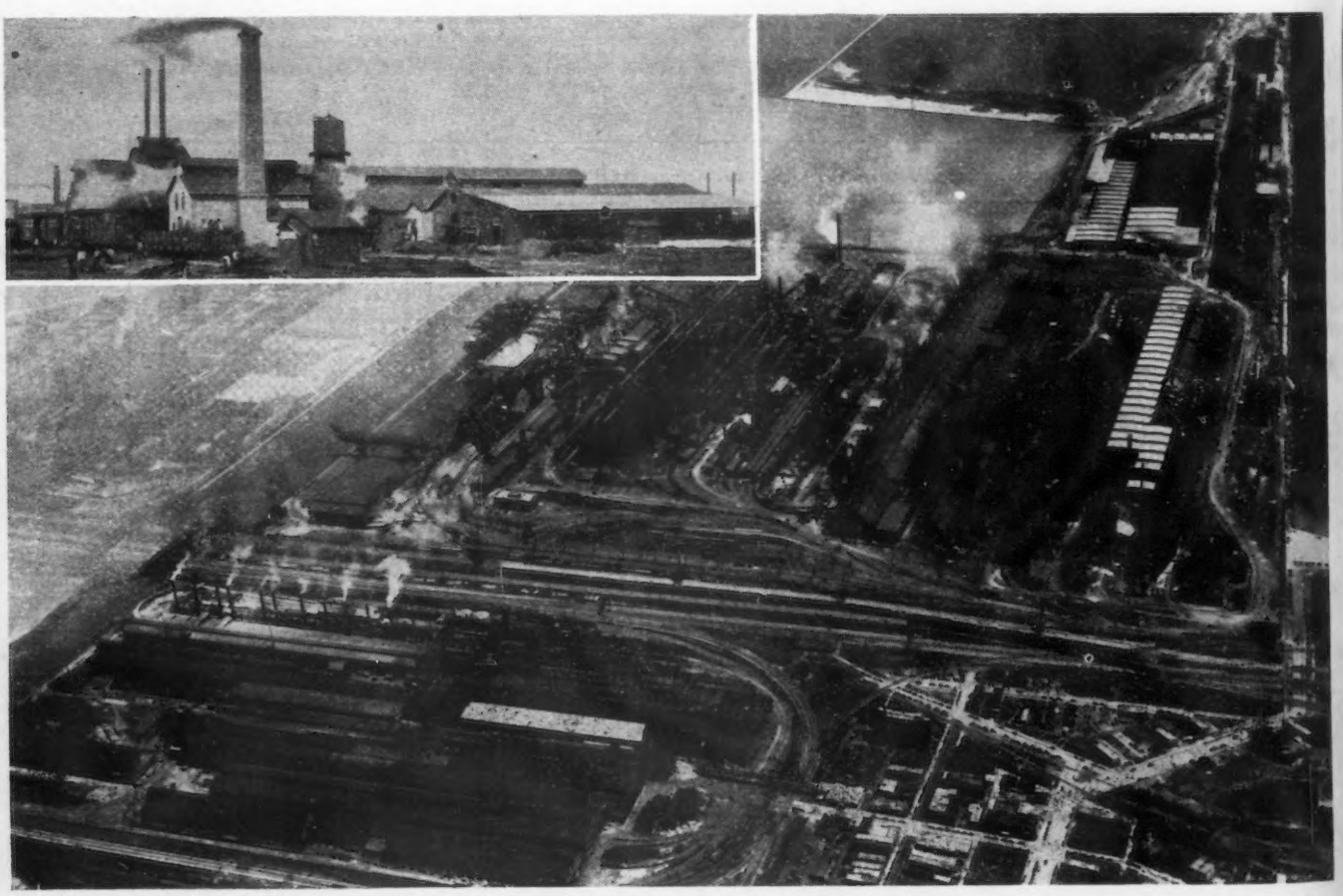
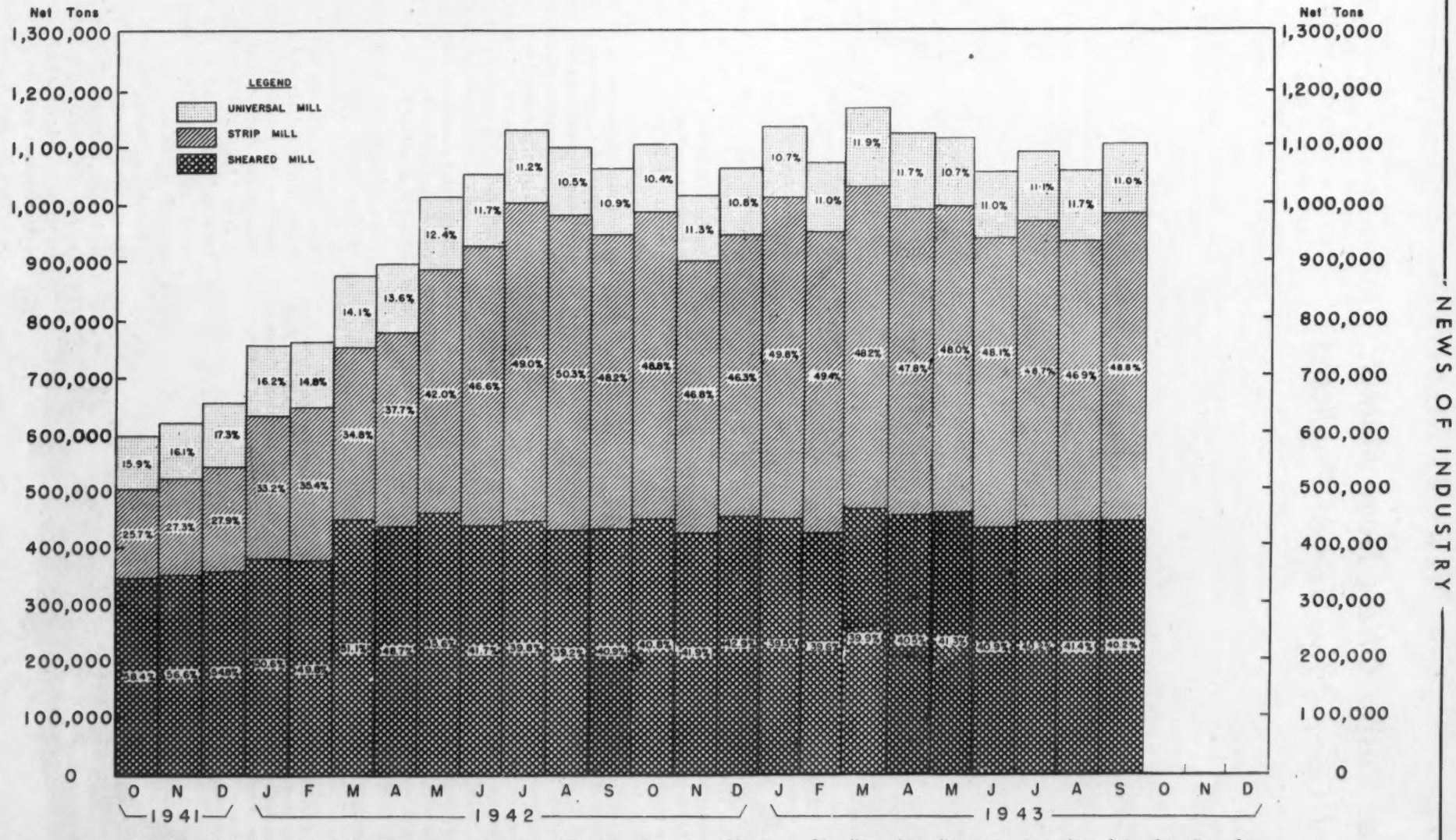


PLATE SHIPMENTS - BY TYPE OF MILL



	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct	Nov	Dec
UNIVERSAL MILL	94,311	99,828	113,467	122,227	111,965	123,152	121,838	125,608	123,114	126,100	115,710	115,372	114,506	114,755	114,650	121,039	118,519	138,805	131,272	119,332	115,986	121,059	124,315	121,929			
STRIP MILL	152,440	169,311	182,604	250,396	268,988	306,195	337,519	425,211	489,704	550,537	551,959	511,909	536,981	474,136	490,867	565,893	529,315	563,302	535,548	535,528	508,534	530,552	497,263	540,337			
SHEARED MILL	346,401	350,868	358,273	381,899	377,770	449,379	436,814	461,375	438,144	447,481	430,197	434,555	449,895	424,708	454,902	448,481	424,167	465,572	454,827	460,060	431,565	438,066	439,358	444,585			
TOTAL	593,152	620,007	654,344	754,522	758,723	878,726	895,971	1,012,194	1,050,962	1,124,118	1,097,866	1,061,836	1,101,382	1,013,599	1,060,039	1,135,413	1,072,001	1,167,679	1,121,647	1,114,920	1,056,085	1,089,677	1,060,936	1,106,851			

(Note: October plate production is unofficially estimated at 1,147,000 tons.)

Post-War Russia Offers Huge Market; Eventual Competitive Threat Predicted

• • • **The post-war goal** of the Union of Soviet Socialist Republics is "to surpass the most advanced capitalistic countries in per capita production of iron, steel, fuel, electric machines and consumer goods," is the considered report of Lewis L. Lorwin, investigating the subject for the Twentieth Century Fund of New York, an economic research foundation.

Russia's post-war aspects for the United Nations appear to offer a large and hungry export market during the reconstruction period. Then will come an era of competition in the opinion of Mr. Lorwin. The length of these periods depends on the speed with which Russia can rehabilitate itself and on accomplishment of its planned industrial expansion. The effects of reparation claims, post-war Lend-Lease and United Nations' gratuities will unquestionably be deciding factors in the time element.

Fundamentally these aims appear to have always been the goal of Russia, it is said. The catastrophic results of involvement in the major part of the land fighting in this war are reported to be considered by the Russians as merely a set-back in their plans leaving their original goal still remaining to be attained. Evidence of this is seen by Mr. Lorwin in reports of the Eighteenth All-Union Conference of the Communist Party of USSR in Moscow. At that time the Central Committee of the Communist Party was directed to draw up a 15-year plan designed to achieve these goals he says.

Communism is not dead nor dying in Russia. Mr. Lorwin's observations are that the aim of the Soviet Union is to build a socialist society and to lay the foundation for a transition to communism. This is the official doctrine of the Communist Party and by Joseph Stalin's own words Russia "has all the necessary prerequisites for the realization of socialism" and can develop along socialist lines independently of other countries.

Liquidating of "exploiting classes," the basis of the Second Five-Year Plan (1932-37) plus the unprecedented liquidations effected by the war, are believed to have mostly completed this aim. The aim of the Third Five-Year Plan (1937-42) dedicated to "establishing a classless Socialistic Society," even though interrupted by the war, is believed to have progressed and may possibly be progressing still under cover of the war. The Fifteen-Year Plan, originally established to build-up the country technically and industrially and to raise the living standards of the people as a means of gaining complete communism, ties in well now with the post-war needs of the war torn nation as the plan most likely to be followed. Further, the intensified industrialization of the nation, started between the years of 1928 and 1940 but tremendously exploited since the beginning of the war, would appear likely to be maintained in the post-war period.

During the first Five-Year Plan (1928-32) 1500 new industrial establishments were put into operation; between 1932-38 about 2100 new plants were begun and between 1938-40 some 2900 more plants were started. New plants with capitalization of over 165 billion roubles were started in the period from 1928 to 1940. Workers increased from about 12 million in 1929 to over 30 million in 1940.

As a result of this growth Russia now has huge mines and plants and factories with the latest equipment. It has created its own steel alloys, electric machinery and apparatus, manufacture of motors, automobiles, machine tools, aniline dyes, artificial silk, heavy chemicals and many other enterprises. It has developed synthetic rubber and greatly expanded the planting of rubber bearing plants. Cotton, once a heavy import item, is now grown entirely within Russian borders.

In 1939 Russia held fourth place in the world for the output of coal, second in the production of iron ore, third in the production of pig iron, and ferro-alloys, third in steel, second in copper smelting and an enviable position in the production of aluminum, electric power and machinery.

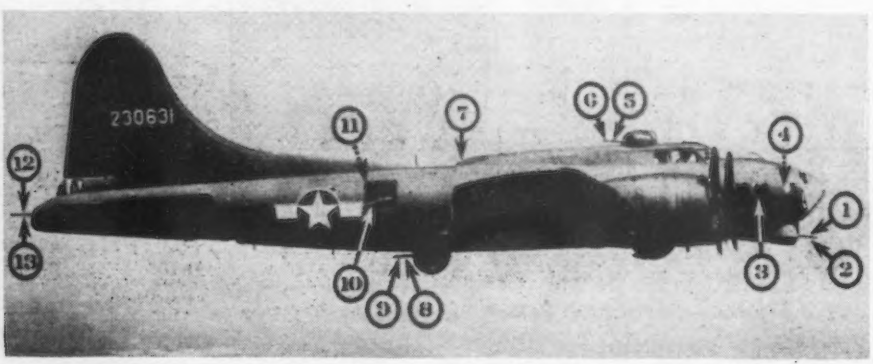
Russia, according to Mr. Lorwin, has three plans for post-war rehabilitation. One, would be to repeat the industrial procedures and hardships of the First and Second Five-Year Plans. Some help for such a procedure is seen in the intensified industrialization of the areas east of the Urals plus the present availability of trained technicians.

Second, a modification of the first plan, eased by extending the rebuilding process over a longer period of time with minimum emphasis on industrial growth beyond pre-war levels and a maintenance of military expenditures to a minimum level. This presupposes external safety for Russia and looks to the aid of reparation claims against Germany and possible Allied economic aid.

The third method is to rebuild and develop Soviet economy with the aid of the United Nations, particularly Great Britain, Canada and the United States. Great Britain and Russia have approved this method in general terms through the Anglo-Soviet Agreement of June 11, 1942. United States has not expressly agreed to aid but the principles of Lend-Lease seem to imply such intentions.

Russia, according to Mr. Lorwin, has stated its position clearly with regard to its economy. It has declared against economic self-sufficiency and favors exports insofar as its industrial re-development permits. As such Russia apears to offer a prodigious post-war market during the reconstruction period.

FORTRESS FIREPOWER: The big Boeing B-17G Flying Fortress now has the protection of 13 (not so unlucky) machine guns of .50 caliber. Each of the encircled numerals in this photo indicates the position of one of the guns. Everybody but the pilot has an extra job manning a gun.



Official Signal Corps Photo

There'll be elbow-bending at the front

IN 15 MINUTES !

Up at the front where the fighting's thickest, no matter where the action—our boys need something more than food and ammunition. Throats parched by the heat of battle cry for water. So the Service of Supply must see that sufficient quantities of water safe for drinking reach the firing line—against all obstacles.

Where roads end, native water carriers lug the precious liquid forward in "Blitz" cans. Another use for these unusual five-gallon metal containers is the transporting of vital gas and oil to planes, tanks and other mechanized equipment in battle action far from their main base.

Because our armed forces need countless thousands of "Blitz" cans—in Europe as well as the South Pacific, the Rheem Manufacturing Company depends on high-speed DeVilbiss Spray Painting Equipment to give them the kind of finish that will stand up against the ravages of desert sand, jungle damp and salt sea air.

In similar manner, DeVilbiss Spray Systems are now assisting countless other manufacturers in practically all fields of war production to speed the day of final Victory. When that day comes, with the "know how" born of solving special wartime finishing problems to supplement its long experience, DeVilbiss will be ready to provide the correct spray equipment for your peace-time products, no matter how different they may be.

THE DEVILBISS COMPANY • TOLEDO 1, OHIO

Canadian Plant: WINDSOR, ONTARIO

PROUD to have won the coveted Army-Navy "E" for excellence in war production, the men and women of DeVilbiss pledge to continue giving their all-out best—for Victory.

DEVILBISS
SPRAY SYSTEMS

SPRAY EQUIPMENT • EXHAUST SYSTEMS • AIR COMPRESSORS • HOSE & CONNECTIONS

ARMSTRONG

Start right.. with the correct

ARMSTRONG TOOL HOLDER

Because ARMSTRONG TOOL HOLDERS have strength far beyond normal requirements, and take all standard cutter bits, lathe, planer and shaper operators frequently set up these machine tools with the first ARMSTRONG TOOL HOLDER at hand, rather than selecting the correct size and type tool holder for the operation to be performed.

Today with maximum production demanded from every machine tool and man hour, it is important that every operation be ***started right,*** with the correct ARMSTRONG TOOL HOLDER . . . the tool holder, especially designed for that operation, which holds the cutter at the correct cutting angle, gives the most efficient tool approach, and cuts efficiently at greatly stepped-up speeds and feeds, limited only by the capacity of the machine tool.

Write for an ARMSTRONG C-39 Catalog today, and check to be sure that you are using the correct ARMSTRONG TOOL HOLDER on each operation.

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"The Tool Holder People"

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Eastern Warehouses & Sales Office: 199 Lafayette St., N.Y.

Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG TOOL HOLDERS Are Used in Over 75% of the Machine Shops and Tool Rooms

Priority Changes

L-54-c—Int. 2 makes it clear that persons receiving WPB authorization to purchase restricted types of office machinery must buy it from the supplier named in the authorization and are permitted to procure only the brand of equipment specified. (11-6-43)

L-83—Amended order permits renewal of certain food machinery leases without WPB approval. (11-4-43)

L-102—Amended order lifts ban on sale of some used electric generating equipment. (11-6-43)

L-131—Amended order rules that military insignia containing plastic or metal may be produced only on orders or contracts originating in certain specified government agencies or firms designated by WPB. (11-5-43)

L-140-b—Order liberalizes production of flatware and hollowware. (11-5-43)

L-249—Amended order considerably eases previous restrictions on the sale or shipment of dental units, chairs and miscellaneous equipment. (11-5-43)

L-250—Amended order permits the use of oversize contactors on electric motor controllers under the same specified conditions only for controllers listed in Tables 1 and 4 of Appendix A. (11-1-43)

M-21-b-2—Order differentiates between dealer and warehouse, thereby applying different rules for the business handled by each. (11-4-43)

M-43—Amended order permits certain new uses of tin. (11-3-43)

M-293—Dir. 1 rules that all purchase orders which were approved or delivery schedules which were frozen prior to Sept. 17, under provisions of orders superseded by Order M-293, as amended that date, retain their approved or their frozen status. (11-5-43)

Price Briefs

- Amdt. 18 to Order A-1 of MPR 188 authorizes manufacturers to increase by nine per cent their maximum prices for steel warm-air furnaces. (Release No. OPA-3401)
- MPR 489, as amended, provides dollars-and-cents ceilings for a group of important alloying metals used in the making of steel. (Release No. OPA-3393)
- Amdt. 50 to RSR 14 authorizes regional OPA administrators to establish dollars-and-cents maximum prices for wholesalers and retailers of ash and garbage cans. (Release No. OPA-3417)
- Amdt. 4 to Order A-2 of MPR 188 establishes an adjustment procedure substantially the same as that contained in the Maximum Import Regulation for applications for price adjustment by industrial users of imported materials.

New WPB Forms

WPB-971—Cast iron products; Producer's monthly report of shipments, unfilled orders, production, and monthly capacities.
WPB-1334—Semi-monthly report of new railroad type car deliveries.
WPB-2021—Zinc dust: Producer's monthly report on production, stocks and shipments.
WPB-180—Steel ingots (including steel for castings): Producer's monthly report of capacities and production.
WPB-2919—Consumption and stocks of scrap and secondary lead and tin.
WPB-983—Cadmium: Producer's or distributor's monthly report of stocks, production, or receipts and shipments.
WPB-2681—Steel castings: Producer's monthly report of shipments, past due and unfilled oders and operations rate.
WPB-970—Steel forgings: Producer's monthly report of shipments, unfilled orders and total steel consumed.

Consider the fourth dimension—TIME

ARCOS CORPORATION

ARC WELDING ELECTRODES
ELECTRIC WELDING MACHINES

401 NORTH BROAD STREET • PHILADELPHIA 8, PA.

AN OPEN LETTER TO USERS OF
ARCOS STAINLESS ELECTRODES:

Today we are placing orders to make electrodes for shipment to you 4 to 5 months hence. It takes about 4 months from the time we place an order for the special stainless core wire before we receive it. After that, it's plain sailing to make the electrodes.

We know that we cannot expect all of our customers to know exactly what they will want 5 months hence, but we do believe that a large number of the users of Arcos electrodes have their work planned far enough in advance to give us their orders now. If a large percentage of your requirements could be placed sufficiently far in advance, we would be able to take care of both the large and the small orders on time.

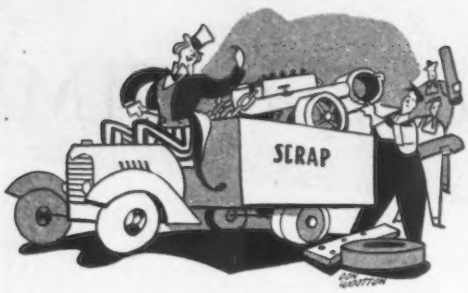
I address this letter to you in that spirit of mutual cooperation which has long stood as the keystone in the relationship between Arcos Corporation and its customers and distributors.

May we have your major orders at least 4 months in advance?

Very truly yours,
ARCOS CORPORATION

R. D. Thomas

R. D. Thomas
President



57,400,000 TONS OF SCRAP!

That's what Uncle Sam must collect!

That's what the steel industry of the United States will need to meet its war production program.

Do you realize how much scrap this is? It would take 771,000 freight cars to haul this tonnage. They would make a train 6,717 miles long!

Why is so much scrap needed? In making steel, the normal mixture that goes into the furnaces is 50% scrap and 50% pig iron. In foundries the proportion of scrap to pig iron is much higher. So we in this country must actually produce more scrap than pig iron if we are to keep the war production program going full-blast.

It is an actual fact that half of every ship, half of every tank, half of every gun, used by our Armed Forces, is made from scrap.

The scrap piles of the nation's steel plants are running low. This time it will take "fine-tooth-combing" to replenish our stock. Every farm, every factory, large and small, every shop, store, office and home must start its own drive for scrap.

You can help! Everybody can help! Start now to get out everything made of iron or steel that you do not absolutely need. Get it out where Uncle Sam's trucks can pick it up.

REMEMBER—our boys out there on many fronts need it—and they are depending upon you to get it. So everybody dig, dig, dig for SCRAP!

Geo. D. Trundle Jr.
President

THE TRUNDLE ENGINEERING COMPANY

Consulting Management Engineering

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Small Jig Coal Washers Aid Coke

• • • With steel mills requiring better quality coke for increasing pig iron output, operators of truck mines producing coking coal may find it advantageous during the war to install small, inexpensive jig washers to clean the coal, Dr. R. R. Sayers, director of the Bureau of Mines, said recently.

Dr. Sayers reported that the performance of 5 to 10-ton-an-hr. jigs with screen surface areas of 9 to 12 sq. ft. compares favorably in the Alabama coal fields with that of standard-size, single-compartment jigs in both ash reduction and recovery of washed coal.

Supplies of Raw Materials Adequate, Institute Reports

New York

• • • On-hand and visible supplies of metallic raw materials for steelmaking appear sufficient to permit capacity production for a normal period ahead, unless unforeseen interruptions occur, according to the American Iron & Steel Institute.

Steel industry inventories of iron ore are lower than a year ago but are expected to be sufficient to keep all blast furnaces in full operation, including new stacks. Stocks of steel scrap show increases over a year ago, but are not much higher than they were in January, 1940. Furthermore, the tonnage of scrap in inventory a year ago was too low in relation to the rate of consumption. Meanwhile, however, steel plants consumption of scrap per ton of steel ingots produced is tending to decline as a result of the greater iron production.

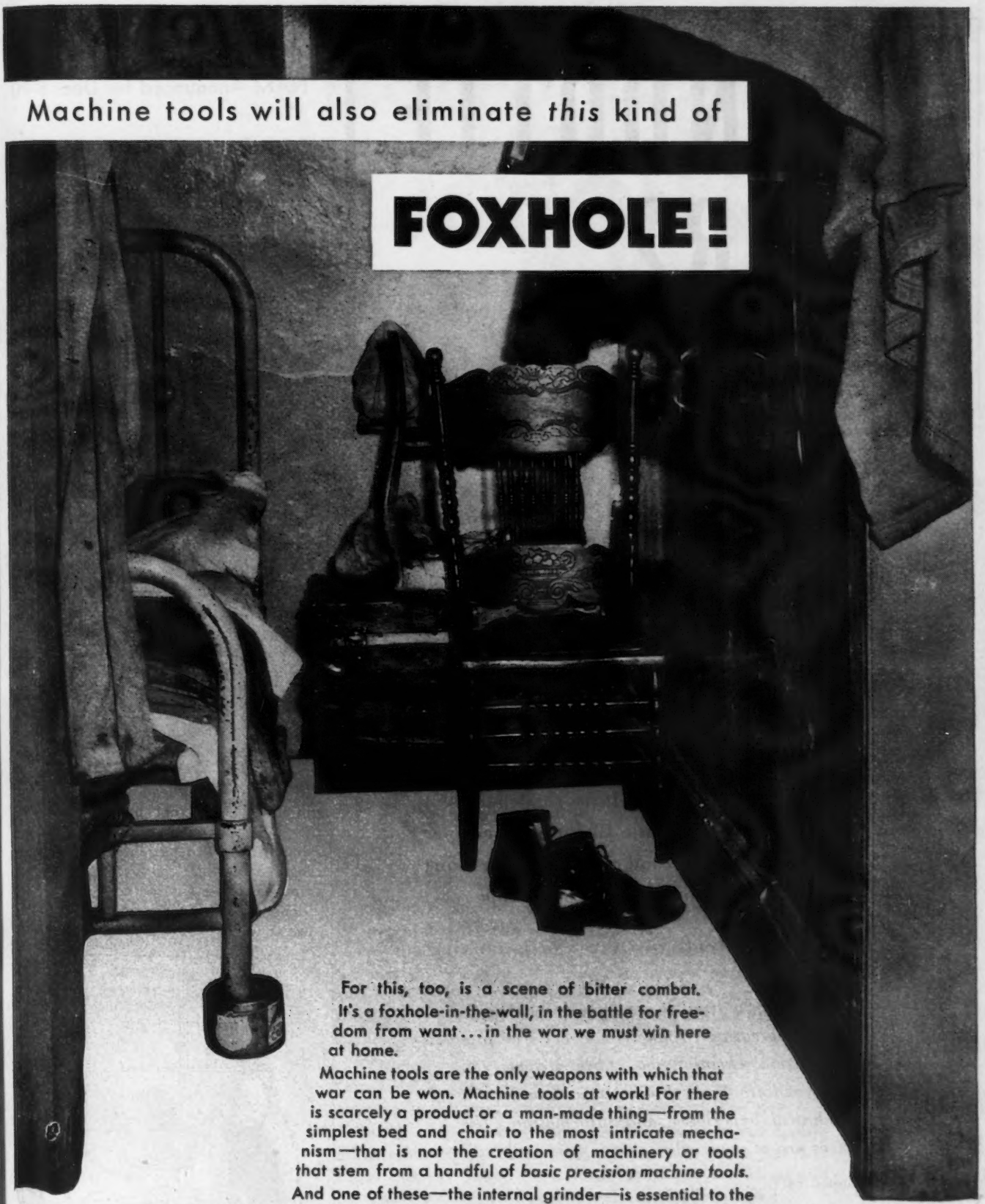
Through the American Industries Salvage Committee steel producers have offered to meet a portion of the cost of the WPB's national scrap drive, says the institute.

On Sept. 1, steel plants had a total of about 39,700,000 gross tons of iron ore in inventory, or about 9 per cent below the tonnage a year ago.

Scrap inventories in the yards of steel plants, as reported to the institute, on Sept. 1 of this year totaled 3,936,000 net tons, about 40 per cent above the total on hand a year earlier. That tonnage, however, is almost 100,000 tons less than the total on hand at steel plants as recently as July 1 of this year.

Machine tools will also eliminate *this* kind of

FOXHOLE!



For this, too, is a scene of bitter combat. It's a foxhole-in-the-wall, in the battle for freedom from want... in the war we must win here at home.

Machine tools are the only weapons with which that war can be won. Machine tools at work! For there is scarcely a product or a man-made thing—from the simplest bed and chair to the most intricate mechanism—that is not the creation of machinery or tools that stem from a handful of *basic precision machine tools.*

And one of these—the internal grinder—is essential to the creation of nearly every machine and tool that will make for a finer standard of living after this war.

It is because of this that the job ahead of us, here at Bryant, will continue to be a truly great one when the war is won. Call on us!

BRYANT

BRYANT CHUCKING GRINDER COMPANY Springfield, Vermont, U. S. A.

WYANDOTTE R2*

It's NEW

—A product developed to prevent the rusting of ferrous metals for periods of from 5 to 10 days.

This product is ideal for preventing rust between production operations.

Wyandotte R2 is in powdered form and practically neutral.

One example of its many uses: steel cartridge case manufacturers cleaning cases in two compartment power washers use Wyandotte R2, at ½ ounce per gallon of water, in the second compartment rinsing operation, 140°F.. with no drying operation.

Wyandotte R2 prevents rust prior to lacquering.

There is a specialized Wyandotte Metal Cleaning and Degreasing Product for every war production metal cleaning job. Located near you is a Wyandotte Field Engineer with a wealth of technical experience and information. His services are at your call.

*Patents applied for.

Wyandotte

SERVICE REPRESENTATIVES IN 88 CITIES

WYANDOTTE CHEMICALS CORPORATION
J. B. FORD DIVISION, WYANDOTTE, MICHIGAN

● Wyandotte Chemicals Corporation consolidates the resources and facilities of Michigan Alkali Company and The J. B. Ford Company to better serve the nation's war and post-war needs.

Second War Congress of NAM Announced for Dec. 8-10

New York

• • • **The second War Congress** of American Industry, 48th annual convention of the National Association of Manufacturers, will be held Dec. 8, 9 and 10, at the Waldorf-Astoria, New York, it was announced by NAM president, Frederick C. Crawford. The theme of the Congress this year will be Production for Victory and Postwar Jobs.

Four headliners scheduled to speak are: Donald M. Nelson, chairman of WPB; Joseph D. Eastman, director of ODT; Wilfred Sykes, pres., Inland Steel Co., Chicago, and Tom M. Girdler.

Bendix Product Aids Military Four-Wheel Drives

South Bend, Ind.

• • • **A new type of** universal joint, the Bendix-Weiss, is in production by Bendix Aviation Corp., providing rolling power for jeeps, half-track trucks, and a majority of all multiple-drive vehicles employed by the services.

The Bendix-Weiss joints consist of two shafts with cupped, yoke-shaped members containing steel balls, which are located in front axles, and which transmit torque from the differential to the driving wheels. The action of this universal joint permits it to do its job at a "constant velocity," minimizing load fluctuations and resulting loss of power, and at angles three times as great as practicable with previous types. Steering is said to be easier also.

"If you watched your machine as much as that blonde you wouldn't be losing time!"

Behind every FIRING *Line* there MUST be a PRODUCTION *Line*

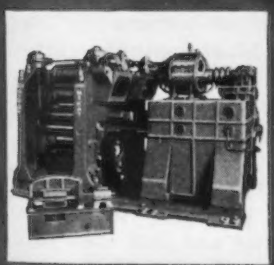
Official U. S. Signal Corps. photo

AMERICA'S production lines are backing her fighting men with the greatest armada of naval vessels in the world—with thousands upon thousands of the best bombers and fighter planes she can produce—and with all the other vital materials of war in such staggering quantities that a complete Allied victory is the only answer.

When victory is won, Industry's task is only half accomplished. Industry must turn its tremendous resources to backing up America in winning the peace.

Today, The McKay Machine Company is producing machinery for making guns, tanks, and jeeps for war time; but, in peace time America these machines will be employed in making products for better living.

Buy War Bonds!



McKAY LEVELLER

McKAY DRAWBENCHES

McKAY TUBE MILLS

THE McKAY MACHINE CO.

Engineers and Manufacturers of
SHEET, TIN AND STRIP MILL EQUIPMENT
YOUNGSTOWN, OHIO

We also build: TUBE DRAWBENCHES, BAR SHEARS and ROTARY POINTERS

ASSOCIATE COMPANY
THE WEAN ENGINEERING CO., INC., WARREN, OHIO

METCO Means Power to Spare
with half the air!

METCO Metallizing Guns keep spraying when pressure drops to 40 p.s.i.

DOES YOUR metallizing gun operate inefficiently when the compressed air supply is used heavily elsewhere in the plant? *Does it even stop completely?* In either case, it is costing you time and money. METCO Type E or 2E Guns never require more than 65 p.s.i. . . . *and will operate efficiently at pressures as low as 40 p.s.i.*

Even without fluctuating air pressures, metallizing equipment which demands 85 p.s.i. is costly. High pressures mean greater air consumption . . . more horsepower . . . larger compressors. Conserve vital power and equipment! Get maximum economy and operating efficiency in *every* respect—by specifying METCO! Write for particulars, prices and priority data.

METALLIZING ENGINEERING COMPANY, INC.
38-22 30th Street Long Island City 1, N. Y.
In Canada: B. W. Deane & Co., Ltd., Montreal

Ready — the first real Metallizing Handbook

KNOW-HOW is as important to successful metallizing as equipment, and METCO provides *the best of both.* Packed in the carrying case with each METCO Gun is a copy of this new, 80-page Handbook on every phase of metallizing—together with a complete Gun Instruction Manual. Extra copies of the Handbook can be obtained for the nominal charge of $1.00.

METCO
REG. U.S. PAT. OFF.

WORLD'S FINEST METALLIZING EQUIPMENT

Labor Dep't. and Treasury State Termination Aims

Washington

• • • **Labor maintains** that dismissal compensation will not be enough when American industry begins to reconvert to peacetime production and will probably move to have the present unemployment compensation rates raised. Appearing before the Subcommittee on War Contract Termination of the Senate Military Affairs Committee recently, A. F. Hinrichs, acting commissioner of the Bureau of Labor Statistics, representing Labor Secretary Perkins, also took the Army's line in its controversy with the General Accounting Office over the termination of contracts. He said that he believed the risks cited by Comptroller General Warren could be balanced by the damage that would be wrought on business if settlements were delayed.

Randolph Paul, General Counsel of the Treasury, declared that industry's ability to reconvert promptly depends "upon the availability of liquid funds with which to pay labor and purchase raw materials. Mr. Paul called attention to the recommendations he had previously made to the House Ways and Means Committee for an immediate credit on the tax refunds due under the two year carry-back plan, and again stressed their adequacy.

Both Mr. Paul and Mr. Hinrichs favor the plan of terminating contracts by individual companies rather than by individual contracts. Mr. Paul said that the country's whole competitive structure depends on whose contracts are terminated first.

In regard to sub-contractors, he thought that settlement with them would be difficult and that some sort of government loan arrangement should be set-up.

Several other of the Labor Department's views, as given to the Committee by Mr. Hinrichs, followed the line of government aid in business. He said that if necessary the government should purchase the contractor's claims or provide government-insured loans.

The other points brought out by the Labor Department were:

1. There should be quick cash available to subcontractors and small business men.
2. There should be a unified program of termination.
3. When the war in Europe ceases contracts should be terminated in the communities which might possibly become ghost towns, so as to give the people in these communities an opportunity to find work elsewhere before the world struggle is completely ended.
4. Certain types of civilian goods could be steered into relief and rehabilitation operations to aid in the transitionary period.

Quick Action

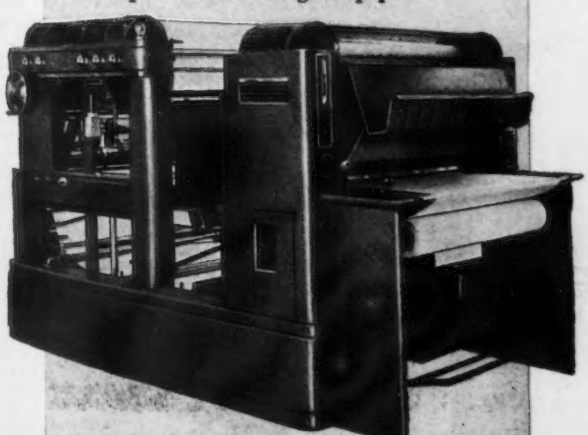
Co-ordinating the work of Engineering and Production Departments when rapid industrial changes are the order of the day is where Pease Continuous Blueprinting Machines shine.

Design changes necessitate **quick action** in furnishing Blueprints. Pease Continuous Blueprinting, Washing, Developing and Drying Machines make this **quick action** possible.

Engineering Departments from coast to coast are speeding changes with Pease Blueprinting Machine production speeds of 30 feet per minute on Model "22" (20 feet per minute on Model "22-16" illustrated). Pease machines deliver quality Blueprints at lower cost per square foot than any other tracing reproduction equipment.

EXCLUSIVE PEASE FEATURES SPEED BLUEPRINT PRODUCTION

- ★ **Sliding "Vacuum-like" Contact** smooths out tracings, prevents errors in printing.
- ★ **Three Speed Lamp Control** provides operation at 10, 15, or 20 amperes, minimizes running speed and dryer heat changes.
- ★ **Actinic "No-Break" Arc Lamps** burn for 45 minutes without breaking arc, resume instantaneously.
- ★ **Horizontal "Floating" Water Wash** floats prints free from tension and prevents wrinkles, stains, bleeding.
- ★ **Quick Change Chemical Applicator System** very economically allows change from Blueprints to Negatives in 20 seconds.
- ★ **Eight-inch Drying Drums,** thermostatically controlled, heated by gas or electricity, dry the prints "flat as hung wallpaper."



PEASE "22-16"
Continuous Blueprinting, Washing, Developing and Drying Machine . . . Actual Production Speed 20 feet per minute. PEASE "22," not illustrated, has an actual production speed of 30 feet per minute.

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Pease Blueprinting Machines A TYPE AND SIZE FOR EVERY REQUIREMENT INCLUDING DIRECT PROCESS PRINTING AND DEVELOPING MACHINES

YOUR QUESTIONS

HOW CAN WE *INCREASE* PRODUCTION?

HOW CAN WE *LOWER* COSTS?

HOW CAN WE ESTABLISH LABOR *HARMONY*?

HOW CAN WE TAKE *KINKS* OUT OF PRODUCTION?

HOW CAN WE *IMPROVE* QUALITY?

HOW CAN WE MEET OUR *SPECIAL* PROBLEM?

ANSWERED

BY THE LARGEST STAFF OF ENGINEERS IN THE COUNTRY IN THIS NEW BROCHURE

BUY WAR BONDS

SENT UPON REQUEST WRITTEN ON YOUR LETTERHEAD

ENGINEERS
DESIGNERS
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PIONEER ENGINEERING AND MANUFACTURING CO.

19649 JOHN R
DETROIT, MICH.

Reserves to Be Formed For Construction and Facilities

Washington

• • • **Beginning with the** first quarter of 1944, all allotments of controlled materials for construction and facilities, save to certain specified military, naval and other programs, will be made from a central materials reserve to be established for this purpose by WPB's Requirements Committee and administered by the Facilities Bureau.

Within the reserve to be established, maximum quantities of controlled materials will be earmarked for each claimant agency, including firm allotments for approved programs and a modest allowance for miscellaneous non-programmed requirements, J. A. Krug said. The central reserve will exceed the aggregate earmarked quantities of controlled materials by an amount calculated to satisfy emergency requirements.

Controlled materials earmarked for a claimant agency will not be transferred without that agency's approval and the Facilities Committee must approve in advance allotments from the non-earmarked portion.

The new controls set for the first time an over-all limit on the amount of materials that will be available for construction and facilities.

Founders to Convene Nov. 17-18 in New York

New York

• • • **Spokesmen for the** National Founders Association have announced the forty-sixth annual convention of the association to be held Nov. 17 and 18 at the Waldorf-Astoria here. A brief outline of the program follows.

Wednesday Morning Session

Report of D. C. Bakewell, pres.: "Preserving America's Private Enterprise System," by George S. Benson, M.A., LL.D., president, Harding College, Searcy, Ark.

Wednesday Luncheon

"Research for Aviation Post War," William B. Stout, director, Stout Research Div., Consolidated Vultee Aircraft Corp.

Wednesday Afternoon

"The Washington Scene," Alexander Wiley, United States Senator from Wis.; "Handling Dispute Cases Before the War Labor Board," J. Harold Madden, Industry Member, Region 1, NWLB.; "A National Labor Policy for Tomorrow," Gilbert H. Montague, Counsellor-at-Law, New York.

Thursday Morning Session

"Renegotiation and Corporate Taxes," L. W. Houston, executive vice-president, Rensselaer Polytechnic Institute, Troy, N. Y.; "Termination of War Department Fixed Price Supply Contracts," Major Elbridge Stratton, New York Ordnance District; "The Manpower Outlook," Lt. Commander E. B. Erickson, Regional Field Officer, Selective Service System.

THE TEST
OF TIME
...and experience!
The Levinson Steel Co. is
today serving 99.1% of the now active
customers who dealt with them in 1933 ...
98.6% of those now active who were on their
books in 1923. Added to these are hundreds
upon hundreds of new satisfied customers.
That's a simple story of growth and progress.
THE LEVINSON STEEL CO.
Warehouse Steel Products—Fabricated Structural Steel
PITTSBURGH, PA.
Levinson Steel Sales Co., Sales Agents
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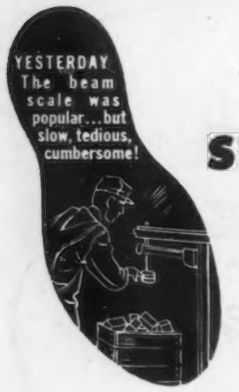
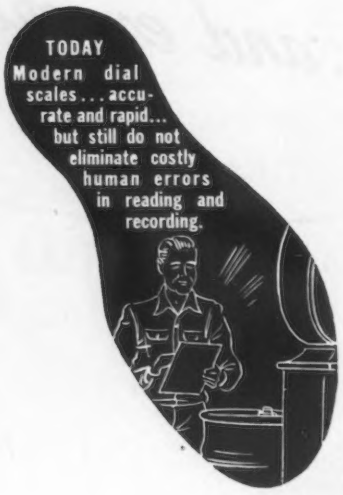
LEVINSON STEEL



STEP INTO TOMORROW
WITH YOUR WEIGHING



TOMORROW
PRINTED Weight Records will be the accepted practice. The Toledo Printweigh, now serving in hundreds of war plants, will give you new accuracy in your weight-control.
Toledo Scale Co., Toledo, Ohio
TOLEDO
NO SPRINGS
HONEST WEIGHT
PRINTWEIGH

TOLEDO
PRINTWEIGH
SCALES

Newest Installment Of Seized Patents

(*Continued from page* 97)

alloys. Abraham Martinius Erichsen, Germany. 11-22-32.

(68) **1,698,010.** Process of producing metallic articles by means of a combined casting and pressing operation. Hermann Barthel, Germany. 1-8-29.

(68) **1,784,600.** Method of casting under pressure and an improved mold for the production of solid or hollow bodies of various forms by casting under pressure. Siegfried Junghans, Germany. 12-9-30.

(68) **1,971,652.** Device for casting under pressure whereby the material to be pressed is brought on to a guide path of any suitable shape situated on the outer side of the mold and serving as guide for the press piston. Paul Haessler, Germany. 8-28-34.

(68) **2,088,134.** Device for driving the movable half of the mold and working piston of die-casting and pressure molding machine. Paul Haessler, Germany. 7-27-37.

(68) **2,120,333.** Apparatus for die casting in which the molten metal is forced with speed into the mold space by applying high pressure thereto and by expelling air from the mold space. Kaname Kubo, Japan. 6-14-38.

(68) **2,206,211.** Machine for casting light metals under pressure. Karl Friedrich Wagner, Germany. 7-2-40.

(69) **1,662,750.** Die-casting machine in which a single unit is used for displacing and controlling the die. Albert Kaufmann, Germany. 3-13-28.

(69.10) **1,766,113.** Molding apparatus for dental purposes. Karl Dehne, Germany. 6-24-30.

(70) **1,638,717.** Die-casting machine with an improved type of valve for controlling the flow of molten metal from the melting to the casting reservoir. Emil Thieslack, Germany. 8-9-27.

(73) **1,793,110.** Die-casting machine in which the liquid metal is held out of contact with the die. Franz Ferdinand Mantei, Germany. 2-17-31.

(74) **2,302,030.** Mold containing electric heating elements not subject to injury by deformation of the mold and capable of easy removal even after such deformation. Franz Husarek, Germany. 11-17-42.

(77) **1,694,118.** Rotary casting apparatus in which molds for various articles to be cast are mounted or arranged on rotary tables. Friedrich Ehrmann, Germany. 12-4-28.

(79) **2,237,723.** Casting vessel for pouring metal into molds with regulated flow. Berthold Zunckel, Germany. 4-8-41.

(80) **1,903,751.** Device for feeding casting pots of linotype and similar machines. Kaspar Bader, Germany. 4-18-33.

(81) **1,771,114.** Heatable ladle for casting metal and steel alloys. Adolf Fry, Germany. 7-22-30.

(82) **1,975,703.** Fluid-tight glass closure. Giorgio Vitale, Italy. 10-2-34.

(84) **2,098,937.** Ladle for casting fluid metal. Heinrich Brinkmann, Germany. 11-16-37.

(86) **1,767,975.** Ladle for low-melting materials. Ignatz Gonyk, Austria. 6-24-30.

(92) **1,644,054.** Automatic machine for casting metal under pressure in which the

9 Warehouses for Wartime Wire Rope Service

At the controls, in the gun turrets, at the radio, in the belly full of bombs, the crew of the flying fortress tensely awaits the contact beam of an Aldis light. Away it sends them to destroy the sinister forces threatening the world.

Watching for signals, too, are users of wire rope. For today wire rope must be used to the very limits of safety. Fortunately its factor of safety is great. Particularly is this true of Union Wire Rope into which specialists, outstanding in the industry, have built long years of knowing how. They have engineered into Union Wire Rope maximum strength and greater toughness to withstand harder use and longer service.

Whatever wire rope you may be working overtime, watch it closely. Giving warning signals is one of wire rope's virtues. It is not apt to fail disastrously if its operator is on the alert. First warning is a few broken wires. A rapid increase of additional broken wires marks the approach of the end of your wire rope's safety and usefulness.

To the limit permitted under conditions of war, our 9 strategically located warehouses and Union Wire Rope distributors are striving to maintain the fullest possible wartime wire rope service. Call for the wire rope help you need, including engineering service.

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A special pile-knitting machine is used to achieve the remarkable Jomac Fabric which is helping to lick the many hot and heavy jobs in America's busy shops and foundries. This fabric is a loop-finished cloth that is thick with air-cells which dissipate heat. Jomac's "cushion" loops give added life and wear . . . allow breathing-space . . . make a sturdy, protective glove that allows constant handling of metals too warm to touch.

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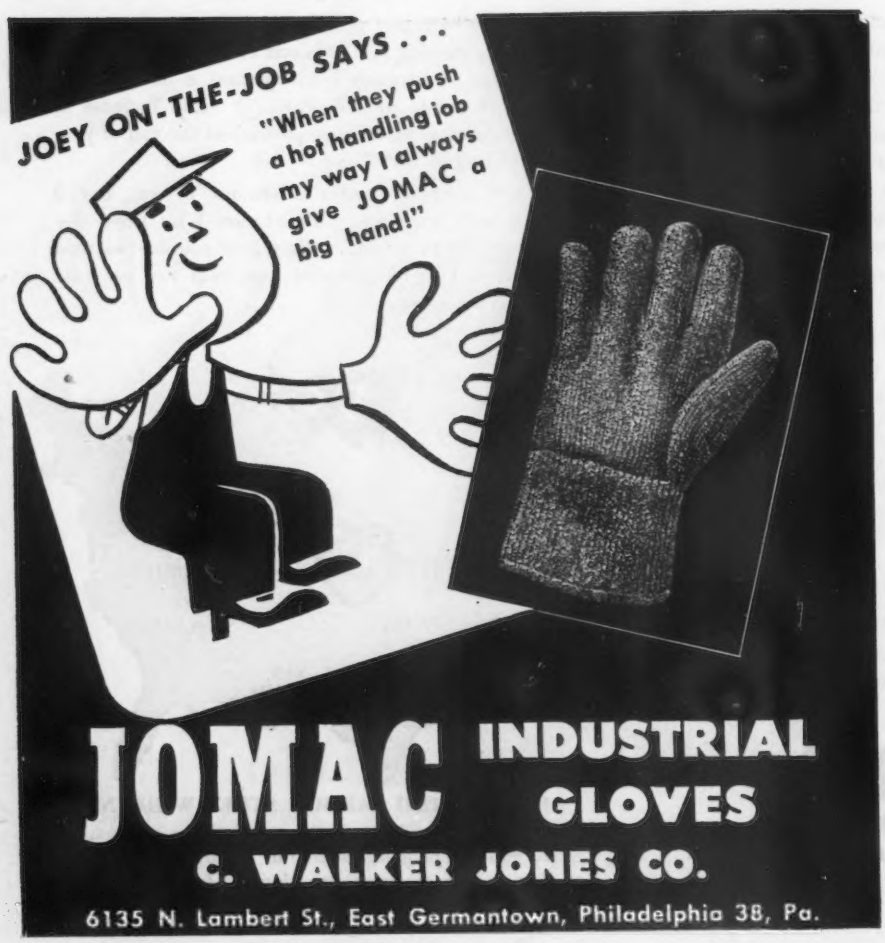
Just try JOMAC GLOVES on your stiffest jobs. Test them for heat-resistance, for wear, for washability, for economy, for *increased production*. Write for full details.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movements of the mold which are necessary for producing castings are automatically controlled by one cam keyed on the shaft of the machine. Otto Eckert, Germany. 10-4-27.

(92) 1,980,333. Pressure die-casting machine with device for uniformly controlling the movable parts by means of gaseous and hydraulic pressure media. Paul Haessler, Germany. 11-13-34.

(96) 1,667,642. Method for prevention of cracking of castings. Carlo Vanzetti, Italy. 4-24-28.

(97) 1,657,475. Apparatus for casting under pressure in dentistry. Kakujiro Inami, Japan. 1-31-28.

(116) 1,760,010. Casting mold for alumino-thermic welding. Hermann Schultz, Germany. 4-27-30.

(116) 1,776,601. Casting mold for alumino-thermic rail welding. Hermann Schultz, Germany. 9-23-30.

(116) 1,793,047. Mold for alumino-thermic welding. Walter Brewitt, Germany. 2-17-31.

(116) 1,856,382. Casting mold for manufacturing zinc containers for galvanic elements, batteries, or the like. Arthur Gassan and Paul Ruck, Germany. 4-3-32.

(116) 2,107,009. Apparatus for molding strut pistons. Ernst Mahle, Germany. 2-1-38.

(121) 1,843,702. Apparatus for manufacturing compound castings. Karl Ackermann, Germany. 2-2-32.

(121) 1,913,358. Method for production of compound castings or case blocks. Heinrich Berve, Germany. 6-13-33.

(126) 1,920,578. Device for producing cast chains composed of single links. Paul Matzow, Germany. 8-1-33.

(136) 2,101,404. Chill mold for casting engine pistons. Ernst Mahle, Germany. 12-7-37.

(136) 1,774,426. Chill mold for casting non-iron metals. Abraham M. Erichsen, Germany. 8-26-30.

(139) 2,153,464. Supporting plate for chill molds. Johannes Haag, Germany. 4-4-39.

(140) 2,212,844. Apparatus for casting hollow bodies comprising a metallic mold and core whereby the casting of cylinders of any size is accomplished easily. Junjiro Nagatsuka, Japan. 8-27-40.

(141) 1,890,027. Casting runner consisting of a refractory channel stone having a slot-like opening in its upper surface and connecting with the channel. T. Brinkman, Germany. 12-6-32.

(141) 1,915,022. Apparatus for casting metal comprising a block of refractory material diminishing in breadth downwardly and having a channel for molten metal in the lower, narrower portion thereof. August Kampt, Germany. 6-20-33.

(141) 2,155,283. Mold for casting solid ingots in large quantities comprising an iron container having a plurality of vertical chambers and consequently preventing the formation of pipes and segregations in the ingots proper. Roman Schustek and Edmond Pajulla, Germany. 4-18-39.

(145) 1,776,591. Casting mold which is set by means of levers and link connection and which produces a mold of variable, substantially square or rectangular outer cross-sectional shape. Fritz Liers, Germany. 9-23-30.

(158) 1,704,006. Auxiliary device for the production of hollow crowns of teeth from cast metal. Wilhelm Kopp, Germany. 3-5-29.

(165) 1,864,451. Core for molds for casting hollow bodies from steel which provides a core that is porous and which allows the gases to escape. Robert Lungen, Germany. 6-21-32.

(165) 2,170,486. Yieldable core for casting heavy hollow steel blocks. Herbert Ruppik, Germany. 8-22-39.

(174) 1,784,346. Cooling means for castings consisting of a cooling body for foundry purposes and comprising a cross-sectionally ramified and endwise pointed strip of sheet metal. Ludwig Fobus, Germany. 12-9-30.

(177) 1,895,135. Water-cooled ingot-mold having an inner and an exterior tube between which ribs for guiding the cooling medium are provided and which accomplishes a satisfactory transmission of heat from the inner tube to the cooling medium. Wilhelm Rohn, Germany. 1-24-33.

(177) 2,119,321. Apparatus for casting metal ingots which obviates the difficulties which arise when casting in open horizontal mounds. Abraham Martinius Erichsen, Germany. 5-31-38.

(184) 1,775,874. Chaplet consisting of a metal strip bent to a frame having two opposite walls and two webs interconnecting the op-

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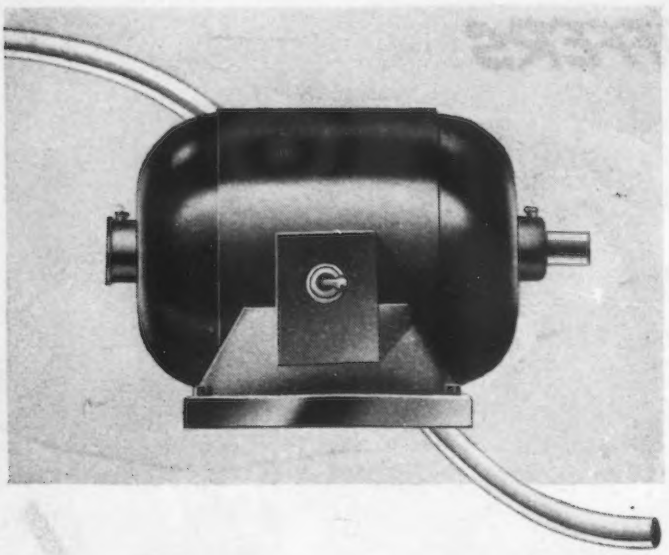

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may be one of the prosaic uses of **PAGE STAINLESS STEEL WIRE.** But its higher tensile strength and non-magnetic qualities have added no little to the performance of modern war-time AC motors.

Tensile strength, corrosion resistance and non-magnetic qualities of Page Stainless Steel Wire have called for its use in Aircraft Control Cables in planes for the American air arm and for our allies.

And **PAGE STAINLESS STEEL SPRING WIRE** controls the mechanism of one of the most effective of modern small arms.

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posite ends thereof. Ernest Sonnet, Germany. 9-16-30.

(187) **1,977,851.** Stamper and hammer for foundries for the purpose of tamping molding sand around patterns, also for rapping the patterns and flasks, and thus eliminate mutilation of the pattern. Heinrich Hepperle, Germany. 10-23-34.

(188) **1,802,681.** Method of making sand cores, particularly pertaining to a binder for cores, consisting principally or exclusively of pure quartz sand. Albert Stahn, Germany. 4-28-31.

(188) **2,211,133.** Method of producing casting molds which considerably reduces the chemical reaction between the melted metal and the mass of the casting mold. Victor Krosta, Germany. 8-13-40.

(189) **2,266,734.** Ingot mold lining consisting of a metal mold lined with a thin coating of refractory material. Gerhard Behrendt, Germany. 12-23-41.

(200) **1,684,700.** Casting article of corrosion proof steel by the process of melting the steel in an open receptacle and casting it in a mold thereby eliminating the influence of oxygen and carbon upon the steel. Friedrich Hauptmeyer, Germany. 9-18-28.

(200) **1,722,124.** Method of casting copper alloys of high melting points in metallic molds. Carl Adey and Carl Piel, Germany. 7-23-29.

(200) **1,746,467.** Process of producing cast iron of any desired structure. Fritz Greiner, Germany. 2-11-30.

(200) **1,966,615.** Metal casting process wherein a mold for the metallic body to be produced is subjected to the action of a high frequency alternating current. Johannes Croning, Germany. 7-17-34.

(200) **1,971,279.** Process and contrivance for producing hollow bodies by casting. Gunther Schwietzke, Germany. 8-21-34.

(200) **2,184,257.** Process for manufacturing chilled hollow balls by centrifugal force which produces a ball suitable for bearing

DAMAGED PROPELLERS FLY AGAIN: Thomas Machine Mfg. Co., Pittsburgh, is manufacturing tools for the immediate repair of bent and warped propellers. Workman in the photo shows how it is done—a hollow blade is held in a cradle and straightened against a metal block shaped to fit its contour at a station numbered on the blade.

WOULD IMPROVEMENT IN One Part ADVANCE YOUR ENTIRE 1944 OUTPUT?

WOULD a review of your year's production reveal one difficult part as cause for "let-downs" in output volume? Were inspection rejects too high on some parts? Did delays in rejections multiply difficulties in maintaining production schedules and reflect loss in enthusiasm or drive for all-out production?

Contact KAYDON

Responsibilities accepted by Kaydon in producing extremely precise, highly essential parts required for war equipment, have demanded unusual development of Kaydon engineering and production facilities. Broadening the application of these facilities, Kaydon has made them available to other manufacturers for present war production and for post-war product development. Possibly these specialized facilities for difficult manufacturing can give you the "on time" deliveries you need to advance your progress in 1944.

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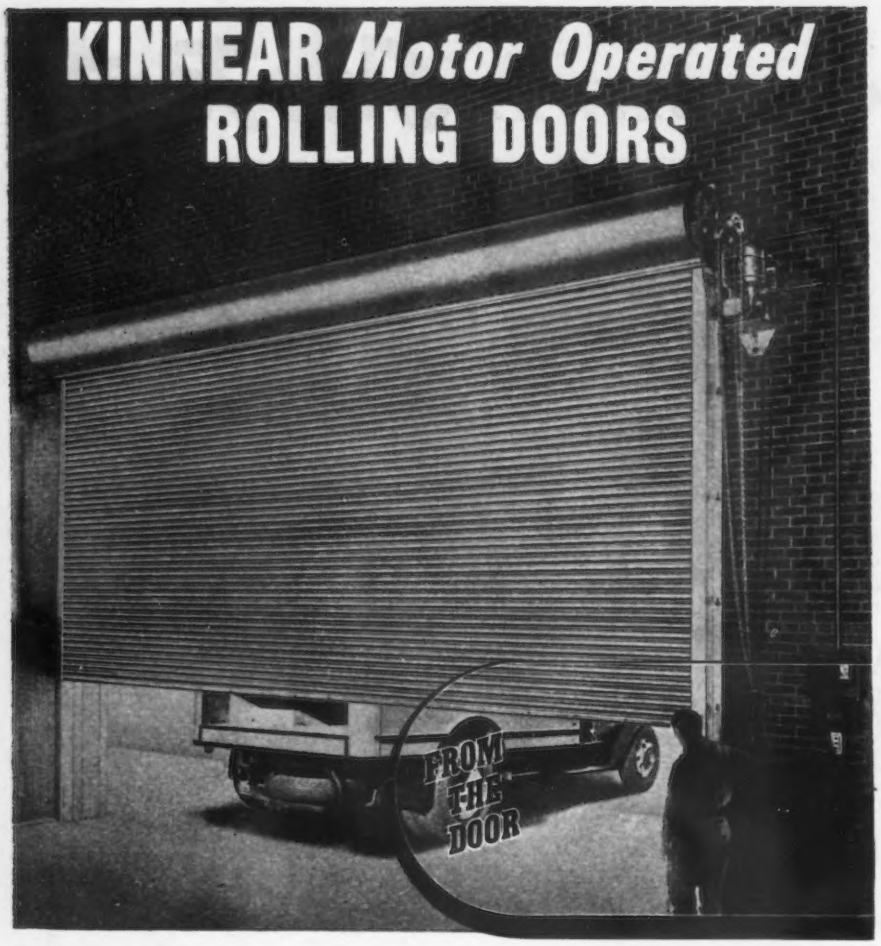
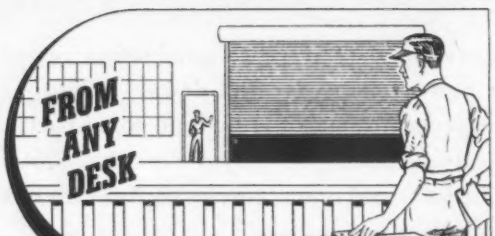


Controlled from any Location



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In addition to remote control, Kinnear Rolling Doors give you extra value in other ways. By coiling compactly above the doorway, they permit full use at all times of all space around openings . . . leave ceilings clear for conveyors . . . avoid blocking off light from nearby lights or windows . . . open out of the way and out of reach of damage. Their strong, durable construction affords valuable protection against intrusion, sabotage, and the elements. Easy to install in old or new buildings. Write today for catalog.

FOR WARTIME NEEDS, Kinnear WOOD Rolling Doors, with motor or manual control, are still available. These time-proved doors save vital war metals! The Kinnear Mfg. Co., 1760-80 Fields Ave., Columbus 16, Ohio.

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and other various purposes. Shinsaku Nakagawa, Japan. 12-19-39.

(200) 2,209,519. Process for producing hollow cast blocks of substantially cylindrical internal shape. Fritz Halbrock and Wilhelm Baumgardt, Germany. 7-30-40.

(200.10) 2,264,457. Process of casting composite metals by the cast-plating method. Walter Roth, Germany. 12-2-41.

(201) 1,819,722. Process for composite casting whereby two kinds of simple metals or alloys of a different nature are melted jointly or separately, then mixed together and poured into a mold. Ihei Sugimura, Japan. 8-18-31.

(203) 1,998,516. Method for uniting steel and bronze intimately with one another, and an improved mold for carrying out this method. Arthur Monzer, Germany. 4-23-35.

(203) 2,166,634. Process for making engine cylinders with an inner lining so that the liner can be made in an easy, effective and cheap way. Alfred Lesage, Germany. 7-18-39.

(203) 2,176,781. Accumulators manufactured from plates. Luta Nelusco Ascari, Italy. 10-17-39.

(203) 2,297,491. Process of manufacturing unitary laminated tubular bearings so as to provide a method by which the bearing metal is intimately united with the body of steel or cast iron. Ernst Meier, Jr., Germany. 9-29-42.

(204) 1,934,901. Process for producing metal rollers of the type used for burnishing rolled band iron or the like. Bruno Witting, Germany. 11-14-33.

(206) 1,671,730. Method of alumino-thermic pressure welding or butt welding elements, such as railway rails and the like, so as to insure substantially uniform heating of the parts to welding temperature. Felix Lange, Germany. 5-29-28.

(206) 1,712,524. Method of preparing sections for alumino-thermic welding through the agency of superheated molten metal poured into a mold in which the parts to be welded are enclosed. Hermann Schultz, Germany. 5-14-29.

(206) 1,741,437. Method of welding rails by means of superheated alumino-thermic metal

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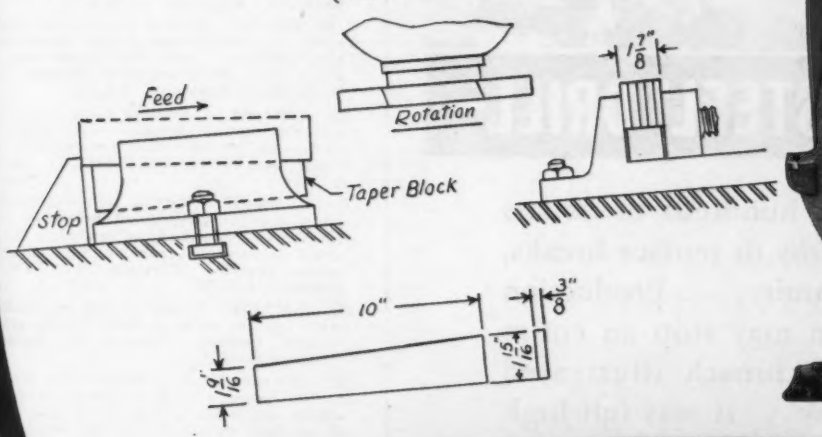
"NOSE SKINS": Worker stacks a pile of "nose skins" which are made of mahogany plywood, 3/32 of an in. thick. They form the leading edge of the glider wing.

3 Days Milling in 3 HOURS with a *Grayson* KENNAMETAL cutter

Work Piece—Airplane Part—Alloy Steel—160,000 p.s.i.
Machine Tool—Milwaukee Milling Machine

Grayson-Kennametal Cutter { Face Mill; Size 8½ dia. ¾" width; Grade S-(KM) with neg. cutting angles; No. Teeth—10



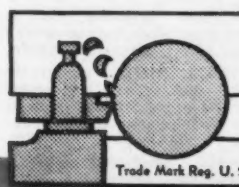
★Recently in an American airplane factory a GRAYSON-KENNAMETAL milling cutter was substituted for a High Speed Steel cutter. It removed as much steel in 3 hours as had previously required 3 days. Production was thus stepped up 500%!

The material milled was an alloy steel airplane part having a tensile strength of 160,000 p.s.i. The cutter, as illustrated, was a face mill, 8½" diameter, ¾" wide, 10 teeth, negative cutting angles, and grade KM carbide inserts. The following are data concerning the operation.

COMPARATIVE PERFORMANCE

	High Speed Steel	GRAYSON-KENNAMETAL Mill
No. teeth in cutter	14	10
Speed	61 RPM	136 RPM
Feed	⅝"/min.	7¼"/min.
Floor to floor time per load	21 min.	3½ min.
Pieces per hour	14.4	86

This outstanding performance is typical of the revolutionary results being achieved with GRAYSON-KENNAMETAL cutters (Meehanite bodies, Kennametal inserts). Write for complete information, or better still, call the nearest KENNAMETAL representative and let him demonstrate the milling improvements that can be effected in your shop.



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Fine for salvage operations, equally good for production operations where full hardened steel parts can easily be drilled to match at assembly.

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so as to produce wear-resisting qualities of the metal forming the treads of the rails. Paul Ruggeberg, Germany. 12-31-29.

(206) 1,771,472. Method of alumino-thermic welding of metal sections of different sizes and profiles. John Wattmann, Germany. 7-29-30.

(212) 1,792,580. Method of producing light metal pistons running in cylinders of harder material for use in automobiles, aeroplanes, and the like. Fritz Fehrenbach, Germany. 2-17-31.

(212) 1,850,477. Method of producing metallic blocks or ingots by casting the liquid metal into molds and thereby producing an ingot of a fine-grain, free of pores, blow-holes and piping. Ernst Roth, Germany. 3-22-32.

(212) 1,889,671. Method for cooling centrifugally cast hollow metal blooms which comprises introducing a cooling body into the space within the bloom. Wilhelm Koehn, Germany. 11-29-32.

(212) 2,167,906. Process of casting carried out by means of metal or chill-molds. Carl Piel, Germany. 8-1-39.

(216) 1,956,910. Method for casting blocks of metal so as to prevent crystal formation and thus produce a uniformly dense cast metal block free from enclosed foreign bodies. Ernst Roth, Germany. 5-1-34.

(219) 1,804,899. Composite metal produced by welding coating metals on to iron cores, preferably by the casting-on process. Hermann Von Forster and Emil Lay, Germany. 5-12-31.

(204) 1,607,117. Method of repairing rail joints for the purpose of providing a simple and effective mode of restoring the worn tread sections of rails or adjacent to the joints therein. Clarence L. Delachaux, France. 11-16-26.

(204) 1,607,118. Method of and apparatus for repairing the ends of rails by the alumino-thermic process. Clarence L. Delachaux, France. 11-16-26.

(82) 1,629,184. Foundry ladle crane which has for its object a form of construction which allows suppressing completely the hoisting of its dead weight and of obviating the use of hydraulic energy, all movements being carried out by electrical means. Arthur Thomas, Belgium. 5-17-27.

(69) 1,669,323. Apparatus for the casting of melted metals under pressure. Emile Brumm, France. 5-8-28.

(206) 1,671,572. Hard-alloy-steel process for the purpose of making parts of track structure, apparatus, such as switches, points, crossings or frogs, and eliminates brittleness chiefly in accordance to the percentage of manganese in the steel used. Clarence L. Delachaux, France. 5-29-28.

(188) 1,685,553. Sand mold for casting magnesium and process of making same so that all oxidation of the metal will be obviated during the casting process. Gilber Michel, France. 9-25-28.

(215) 1,699,612. Method for the production of unhardened castings in metal molds by making use of a lining material which also presents additional advantages. Henri Doat, Belgium. 1-22-29.

(68) 1,717,254. Casting machine in which the molten metal is forced out of a cylinder by means of a sliding piston directly into the molds and which makes it possible to cast with metals having a high melting point. Joseph Polak, Czechoslovakia. 6-11-29.

(23) 1,729,536. Machine of the semi-automatic type for casting under pressure by the use of compressed air or neutral gases. Emile Brumm, France. 9-24-29.

(40) 1,759,728. Molding machine in which the sand is pressed in the molding frame by means of pressing cylinders which are actuated by hand or by a motor. Roger Bachon, France. 5-20-30.

(65) 1,767,394. Apparatus for the manufacture of hollow bodies such as steel pipes and consists in replacing the single projection lip producing a single jet of molten metal by a series of jets. Albert Portevin, France. 6-24-30.

(188) 1,776,686. Molding sand adapted for use in casting pipes by the centrifugal method. Leon Louis Mathieu, France. 9-23-30.

(192) 1,777,975. Method of treating the surfaces of bodies or articles composed of iron in order to protect them from deterioration by fire or chemical actions. Wilhelm Klepsch, Czechoslovakia. 10-7-30.

(16) 1,794,527. Sand-packing device for pipe molds by the centrifugal method. Leon Louis Mathieu, France. 3-3-31.

(65) 1,797,872. Process and apparatus for the

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CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ **Production**

Adaptability

Fixture Saving

Operation Saving

Material Saving

★ **Fine Finish**

★ **Flatness**

★ **Close Limits**

★

. . . . . Especially valuable on jobs like the one illustrated.

THIS is an excellent example of accurate surface grinding of pump body parts on a No. 18 Blanchard Surface Grinder.

These pump parts are held magnetically on a 36" chuck and work is held to very close limits giving a finish suitable for final lapping operation.

The material is high strength forged steel and .004" is removed from each side, to limits of ±.0003". Forty pieces 10⅝" long, 5⅛" wide and .756" thick (80 surfaces) are produced per hour.

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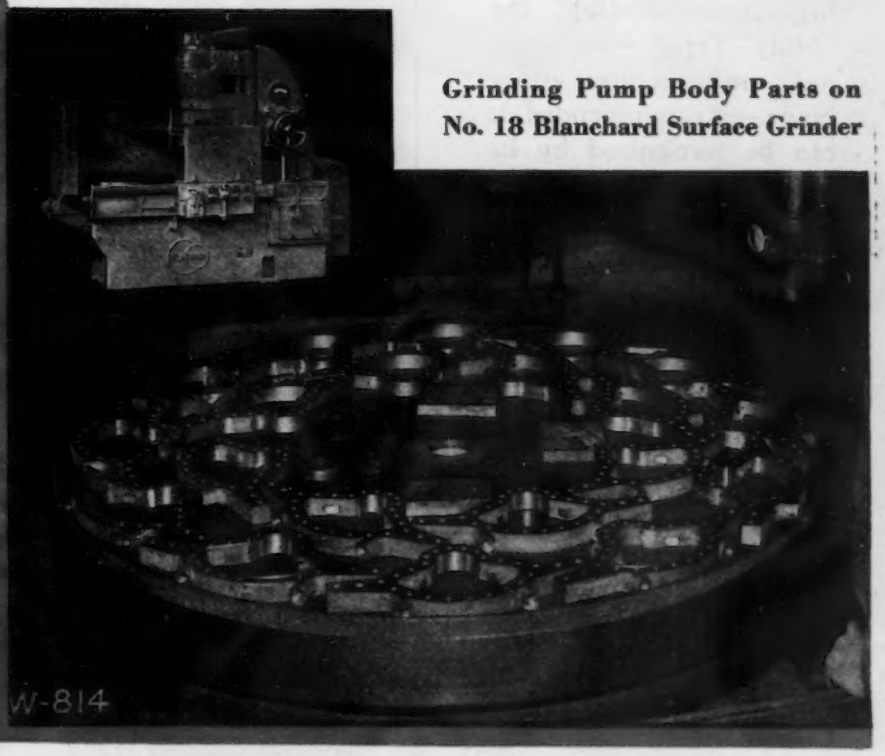

Grinding Pump Body Parts on No. 18 Blanchard Surface Grinder

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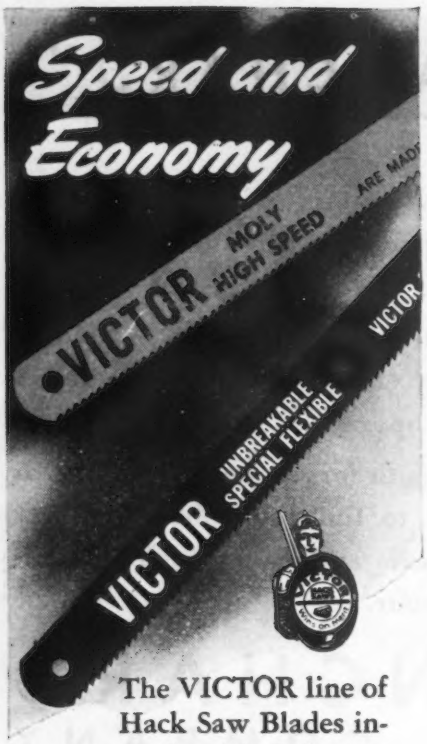


The VICTOR line of Hack Saw Blades includes a blade for any type of metal sawing. For high-speed cutting, the "Moly" Type* — the original molybdenum alloy blade — is recommended. It can be recognized by its gold finish with the name VICTOR in black. For light material and awkward sawing jobs your choice should be the VICTOR Unbreakable Special Flexible Blade. This all-over black blade cuts like an all-hard. Its flexibility eliminates breakage and tooth strippage.

VICTOR has just issued a new catalog covering the complete line of Hack Saw Blades, Frames, Power Saws, Band and Contour Saws.

**T. M. Reg. Blades bearing the name "Moly" are made only by Victor Saw Works, Inc. and affiliated companies.*

VICTOR
SAW WORKS, INC.
MIDDLETOWN, NEW YORK
Makers of Hack Saws, Frames, Band Saws and Power Saws

4766

centrifugal casting of metal pipes whereby the operator can control the tipping of the metal pot and distribute the metal in a uniform manner. Leon Louis Mathieu, France. 3-24-31.

(574) **1,798,326.** Machine for casting articles from plastic or liquid masses which consists of a stationary feeding hopper and a uniformly moving mold belt and other features which accomplish variations in casting. Jens Johannes Jensen, Denmark. 3-31-31.

(94) **1,810,183.** Apparatus for ejecting pipes cast in flasks in one piece. Leon Louis Mathieu, France. 6-16-31.

(64) **1,830,427.** Plant for the manufacture by centrifugation of pipes. Rene Devillers, France. 11-3-31.

(57) **1,839,106.** Apparatus for performing metallurgical, smelting, and molding operations in which all operations are effected within an enclosure in which is created an artificial atmosphere of any desired composition and the temperature and pressure of which may be regulated. William Arthur Loth, France. 12-29-31.

(89) **1,845,193.** Foundry sand rubbing machine in which the cylindrical mullers have such a length that the line of contact of the roller occupies nearly the whole of the actual radius of the disk. Eugene Ronceray, France. 2-16-32.

(81) **1,846,087.** Apparatus for casting molten metal under pressure especially adapted for use in gross production of castings. Reinhardt Christensen, Denmark. 2-23-32.

(188) **1,849,767.** Process of preparing molding sands for easily oxidizable metals such as magnesium. Gilbert Michel, France. 3-15-32.

(21) **1,850,018.** Molding machine which permits the application of the so-called "chain" method of manufacture to the production of foundry molds. Etienne Leyondre, France. 3-15-32.

(574) **1,870,406.** Molding machine for the production of a continuous ingot. Mathieu Douteur, France. 8-9-32.

(69) **1,896,824.** Apparatus for molding under pressure in which the pressure of the fluid acting on the material to be molded is progressive. Paul Mathieu, France. 2-7-33.

(36) **2,093,028.** Apparatus for imparting a given density to substances in powder form and for filling up limited spaces with controllable quantities of the said substances. Willem Bolk, Netherlands. 9-14-37.

(17) **2,101,726.** Manufacture of molds used for casting metal pipes and the like by the centrifugal method. Antonius J. van Zijp, Netherlands. 12-7-37.

(57) **2,244,490.** Automatic casting machine for the casting of lead grids for storage battery plates and the like. Daniel Doyen, Belgium. 6-3-41.

(57.1) **2,096,998.** Apparatus for introducing melts into casting molds especially for dental purposes. Jens Aaberg Ronn, Denmark. 10-26-37.

(65) **2,047,588.** Centrifugal casting machine for producing in refractory lined molds or flasks. Jeremias H. Ledeboer, Netherlands. 7-14-36.

(65) **2,282,501.** Method of vertically centrifugally casting hollow metal bodies by means of a rotating mold and a non-rotating metal core of steady shape. Koenraad Suijk, and Jacob Suijk, Netherlands. 5-12-42.

(68) **1,948,205.** Molding machine particularly designed for molding under pressure. Norbert Jacquemont du Donjon, France. 2-20-34.

(68) **2,191,789.** Machine for the molding or casting under pressure of metals. Jaime de Sternberg, France. 2-27-40.

(68) **2,228,973.** Die-casting machine, hydraulically driven, consisting of a press chamber, a removable closure piece for the press chamber, a mold separate from the press chamber and a piston arranged for feeding the casting material under pressure. Joseph Polak, Czechoslovakia. 1-14-41.

(79) **1,961,063.** Method of casting molten material and apparatus which provides for a perfect mixing before solidification. Paul Miguet and Marcel Perron, France. 5-29-34.

(79) **2,024,854.** Method and means for treating substances which are readily attacked by air when in a hot state particularly for melting and casting magnesium, its alloys and compounds, aluminum and other metals and materials. Henri George, France. 12-17-35.

(84) **2,193,365.** Pouring nozzle which enables the section of the nozzle to be varied during casting. Rene Cantoni, France. 3-12-40.

(86) **2,007,429.** Process for making neutral calcium hypochlorite which can be filtered. Heinrich Klopstock, Czechoslovakia. 7-9-35.

(92) **2,055,944.** Device for producing die castings from metal alloys, in which the material to be pressed is forced from a pressure chamber under a high pressure into a permanent mold. Joseph Polak, Czechoslovakia. 9-29-36.

(139) **1,758,823.** Ingot mold for the purpose of constructing or shaping such molds as to expedite their rate of cooling when filled with fused metal. Marcel Blage, France. 5-13-30.

(177) **1,615,086.** Mold for casting metals for use in rolling mills and which produces metal plates which are free from stresses. Otto Junker, Germany. 1-18-27.

(184) **2,022,214.** Expanding support for casting cores. Emile Martel, France. 11-26-35.

(188) **1,975,398.** Process for the manufacture of molding sand. Jean Malapsina, France. 10-2-34.

(188) **1,975,399.** Process for the manufacture of molding sand. Jean Malaspina, France. 10-2-34.

WOMEN IN FOUNDRIES: There are nearly 700 women doing the grimiest masculine types of foundry work at the General Steel Castings Co., Granite City, Ill. Here foreman M. Andria, who has worked at his job for 33 years, acts as teacher.

A medal for Nancy...

LITTLE Nancy Jane is only six. She stood alone, with all the inborn dignity of childhood, in that historic room amid the admirals, the senators, the great and near-great grown-ups.

She heard a deep, resonant voice say:

> *"For conspicuous gallantry over and beyond the call of duty, the Congress of the United States of America awards the Congressional Medal of Honor to Marvin Clayton — Lieutenant-Commander, United States Navy—killed in action at the victorious Battle of Midway."*

And then a blue ribbon passed over her head. And looking down, she saw a gold medal at the end of the ribbon nestling against her dress.

Little Nancy Jane is only six. She's too young to understand the words of the citation—not quite old enough to realize that this blue-ribboned gold medal is the highest honor our nation can bestow on its heroes.

But not too young to know that never-more will she feel those strong, gentle hands tucking in her blanket ...or hoisting her high in the air for a morning kiss... or patiently guiding her pencil as she scrawls a birthday greeting to Grandma!

Little Nancy Jane is only six—and fatherless! However long actual fighting goes on—this war means sacrifice for little Nancy Jane for the rest of her life!

Every single second lost today on our production lines...every hoarded bit of food, rubber and metal... every moment of complacency or face-saving or temporizing...means more children become fatherless.

Each of us owes something to Nancy Jane's dad... and to Nancy Jane!

The men and women of Weatherhead sponsored this message. Most of us have near relatives in uniform ... sons, husbands, brothers ... sisters and daughters, too. Our task is not dramatic ... but it is vital to every single big weapon. For years we have been making for peacetime purposes the same fittings and devices we are making today. However, responding to the urgent war needs of the nation, we have found ways of producing them in greater quantity than ever before — more than a million every twenty-four hours! So, you see, our skill is also one of the great weapons for winning the war and for building the kind of world we're all fighting for.

Albert J. Weatherhead Jr. PRESIDENT

Weatherhead

THE WEATHERHEAD COMPANY · CLEVELAND, OHIO

Headquarters for fittings, hose assemblies, hydraulic devices and essential machine parts

Plants: CLEVELAND; COLUMBIA CITY, IND.; LOS ANGELES; ST. THOMAS, ONT.

EUCLID CRANES *are*

STANDBY Troubleshooters IN MANY POWERHOUSES!

Interruption of power cannot always be avoided but must not be tolerated a minute longer than necessary when an emergency does occur. Utmost dependability in the standby cranes is therefore requisite.

EUCLID CRANES are popular in this service and are to be found in many leading industrial and public utility power houses. They embody ***speed*** necessary to expedite emergency repairs and ***ease of control*** essential to the proper handling of intricate turbine and generator parts.

WE CAN DELIVER
a limited number of
5 to 10 TON Cranes
in
60 to 90 Days

This Euclid standby crane in the power plant of the Ford Willow Run Bomber Plant is a typical example of recent installations.

Satisfactory performance is evidenced by the roll call of both Euclid Crane and Euclid Hoist users, all discriminating buyers. Many have placed repeat orders and an impressive number have standardized on Euclid equipment.

THE EUCLID CRANE & HOIST CO.
1361 CHARDON RD., EUCLID, OHIO

NEWS OF INDUSTRY

(188) **2,148,642.** Process for the manufacture of molds and cores for castings. Rene Ricard, France. 2-28-39.

Class 153 — Metal Bending

(1) **1,889,803.** Auxiliary device for the manufacturing of separable fasteners by means of which a large number of links may be picked up and arranged. Hugo Henkels, Germany. 12-6-32.

(1) **1,890,300.** Device for automatically arranging the elements of sliding clasp fasteners preparatory to fixing them to the parts to which they are to be applied. Karl F. Nagele, Germany. 12-6-32.

(1) **1,948,379.** Apparatus and method for applying strips of solder to sheet metal. Carl Helle, Germany. 2-20-34.

(1) **2,017,814.** Device for the manufacturing of sliding clasp fasteners. Hugo Henkels, Germany. 10-15-35.

(1) **2,031,567.** Method and apparatus for manufacturing packing. Improvements in or relating to metal covered packing cords, ropes or strands. W. Liedle, Germany. 2-18-36.

(1) **2,066,359.** Device for fixing sliding clasp elements on a supporting band. Karl F. Nagele, Germany. 1-5-37.

(1) **2,087,461.** Machine for applying fastener members to ribbons. S. Wittenberg, Germany. 7-20-37.

(1) **2,094,715.** Apparatus for the manufacturing of zip fasteners, in which eccentrics press the fastener links on to a band and move the band forward intermittently. Karl F. Nagele, Germany. 10-5-37.

(1) **2,203,448.** Apparatus for attaching slide fastener locking members to flexible tapes. A Susskind, Germany. 6-4-40.

(1) **2,217,121.** Device for supplying fastener elements, said device forming parts of machines for the manufacture of slide fasteners. Josef Lindner, Germany. 10-8-40.

(1) **2,240,018.** Device for the production of sliding clasp fasteners of the kind not regularly arranged in a container. Julius Puschner and Josef Puschner, Germany. 4-29-41.

(2) **1,941,953.** Process and machine for manufacture of tubes such as are used for winding ribbon, adhesive tape, etc. Tubes are made from a continuous sheet metal strip. Ernst Pump, Germany. 1-2-34.

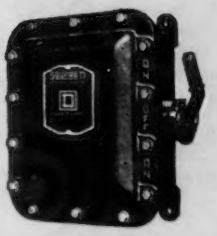
(2) **1,954,332.** Machine for the manufacture of shells for metal cups and similar articles. F. Seitz, Germany. 4-10-34.

(2) **2,004,555.** Method and apparatus for the manufacture of electrical contact plugs or pins such as used in electron discharge tubes or elsewhere where connection is to be made with a socket. E. Kleinmann, and A. Mendel, Germany. 6-11-35.

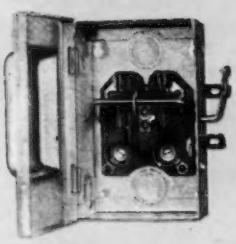
To Be Continued in An Early Issue

"I CAN'T TAKE CARE OF BUTCH ANY MORE, MRS TURNER,—MY MOTHER'S GOING INTO THE FACTORY, TOO, AND SHE'S LOOKING FOR SOMEONE TO TAKE CARE OF ME!"

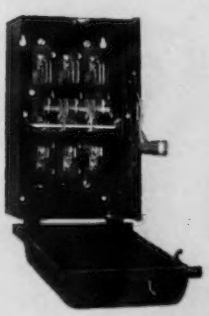
a Complete Line of safety switches



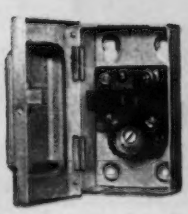
Weatherproof, dust-tight and explosion-resisting enclosures are available with ratings up to 200 amperes. Dust-tight switches approved for Class 11, Group G hazardous locations. Explosion-resisting enclosures approved for Class 1, Group D hazardous location.



General Purpose Switches (Type D) are quick break only in capacities from 60 to 600 amperes inclusive. Thirty-ampere (and rain-tight) switches are not quick break. Made with 2, 3 and 4 pole and 2, 3, 4 and 5-wire s/n systems. 230 volt A.C. and 250 volt D.C.

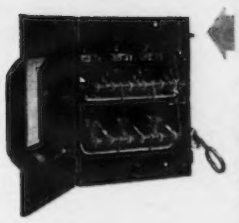


Type A Switches with visible blades. Quick make, quick break and interlocked cover; rated from 30 to 2400 amperes, up to 600 volts. Horsepower rated. Fusible and not fusible. 2, 3 and 4 poles and 3, 4 and 5-wire, solid neutral.

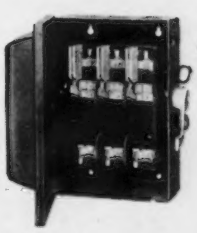


Blue Label Line—Type D Switches are compact, employing a rotary type of blade construction. Made for 2 pole and 2-wire and 3-wire, 230 volt A.C.-250 volt D.C. systems. Available for 30 to 60 ampere fusinas. Front operated.

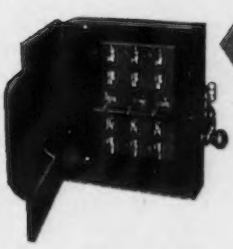
Type A Switches with concealed blades. Quick make, quick break and interlocked cover. Design permits smaller boxes with plenty of wiring space. Up to 200 amperes, 600 volts. H.P. rated. Made in 2 and 3 pole, 3 and 4-wire solid neutral.



Manual Motor Starters are available up to 60 amperes, 575 volts A.C. horsepower rated. Auxiliary blades shunt running fuses when operating handle is moved to starting position. Releasing handle automatically moves blades to running position with fuses in circuit.



Type C Industrial Safety Switches are quick make and quick break. Made up to and including 600 amperes, 600 volt. Fusible and not fusible. Horsepower rated. 2, 3 and 4 poles, and 3, 4 and 5-wire solid neutral. Also available in rain-tight enclosures.



Double Throw Switches. Made in sheet steel or explosion-resisting enclosures, approved for Class 1, Group D hazardous locations. Interlocked covers and quick make and quick break mechanism in sheet steel enclosures.

CALL IN A SQUARE D FIELD ENGINEER
If you have a problem which involves electrical control or distribution, you're welcome to the counsel of the nearest Square D Field Engineer. He is in constant contact with plants of every kind. He studies methods and applications with the idea of simplifying new jobs or doing old ones better.

SQUARE D's unusually complete line of safety switches covers five divisions: *1.* Heavy Duty Industrial Type A. *2.* Intermediate Industrial Duty Type C. *3.* General Purpose (Type D). *4.* Double Throw Switches. *5.* Manual Motor Starters.

The predominance of Square D switches throughout industry speaks volumes for their performance.

ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

DO YOU KNOW THE TRUTH about Hardness Testing?

● The new Clark catalog is more than a catalog.

It is a 20-page reference manual on the history, theory, practice, and equipment for modern, scientific hardness testing. Printed in two colors, size 8½" x 11", it is available without charge to manufacturing executives. Just drop a line on your letterhead to Department IA, CLARK INSTRUMENT, INC., 10200 Ford Road, Dearborn, Michigan.

CLARK
TOMORROW'S ACCURACY TODAY
HARDNESS TESTER

Among the Week's Trade Notes

Aztec Metal Co., 5170 Plankinton Bldg., Milwaukee, has been organized to deal in used metals by Nathan W. Heller, Helen Larson and Robert M. Schoen.

●

Koppers Co., Pittsburgh, has announced the purchase of all physical assets of Coated Products Corp. of Verona, Pa. The business will continue in operation without interruption as the Coated Products Division of Koppers Co. Acquired by Koppers through this transaction are all rights in the Plastipitch process of weather proofing and corrosion proofing of prefabricated metals and steel shapes. Morton I. Dorfan, formerly associated with the Coated Products Corp., has been appointed manager of the new Koppers division.

●

Hub Industries, Inc., Long Island City, N. Y., producers of aircraft parts, have opened a new special development division at Stamford, Conn.

●

Committee for Economic Development has moved its national headquarters from the Department of Commerce Building, Washington, to 285 Madison Avenue, New York 17.

●

Thermoid Co., Trenton, N. J., has acquired the Joseph Stokes Rubber Co., Trenton, and its subsidiary, Joseph Stokes Rubber Co., Ltd., Welland, Ont.

●

Belden & Maitland, Inc., has been taken over by Brad Wright Smith Advertising, Inc., and will henceforth be operated under that name.

The Laughter Corp., Dayton, has been formed as the successor to the Production Products Co., Dayton. Officers of the company are: D. R. Laughter, president; C. W. Wilson, vice-president in charge of engineering; George Laughter, vice-president in charge of sales; and W. B. Kindrick, vice-president in charge of manufacturing. Branch offices of the company are located at 724 United Artists Building, Detroit; 2400 W. Madison Avenue, Chicago, and 507 W. 56th Street, New York, in addition to its principal offices in Dayton.

●

Rotary Electric Steel Co., Detroit, has been purchased by American Co., a subsidiary of Atlas Corp. Operations will continue under the same name and with the same operating organization.

●

Allegheny Ludlum Steel Corp., Brackenridge, Pa., has recently acquired the Carbide Alloy Corp., New York. The property will henceforth be operated as Allegheny Ludlum's Carbide Div.

●

Niles-Bement-Pond Co., West Hartford, Conn., has acquired the Chandler-Evans Corp., South Meriden, Conn. The plants of the Chandler company will continue to operate under the same management and with the same personnel.

●

The Manufacturers' Equipment Co., Chicago, has been purchased by Harry I. Schuster, western engineer for the Potter & Johnson Machine Co., Pawtucket, R. I. It has been moved into a factory building at 3025 W. Atkinson Avenue, Milwaukee. The name will be retained with Mr. Schuster as president; B. A. Schuster, vice-president; Nelson F. Petrie, secretary, and Clarence J. Meyer, treasurer.

o o o

Recent Defense Plant Corp. Contracts

Washington

● ● ● **Defense Plant Corp.**, RFC subsidiary, has authorized the following contracts:

Vega Aircraft Corp., Burbank, Cal., to provide additional facilities at a plant in California at a cost in excess of $175,000, making a total commitment of more than $7,250,000.

Tube Turns, Inc., Louisville, Ky., to provide additional equipment at a plant in Kentucky at a cost in excess of $735,000, making a total commitment of more than $7,250,000.

Anaconda Alloys, Inc., New York, to provide plant facilities in Nebraska at a cost in excess of $16,600,000.

Phelps Dodge Copper Products Corp., New York, to provide plant facilities in Indiana at a cost in excess of $16,000,000.

Columbia Malleable Castings Corp., Columbia, Pa., to provide equipment at a plant in Pennsylvania at a cost in excess of $400,000.

Metal-Mold Magnesium Corp., Cedarburg, Wis., to provide additional facilities at a plant in Wisconsin at a cost in excess of $30,000, making a total commitment of more than $200,000.

The War Department announced Oct. 28:

1. **Authorization** for construction at an Army Air Forces installation in Riverside County, Cal., to cost a million dollars. This work is to be supervised by the Los Angeles district office of the Corps of Engineers.

2. **Award** of a contract to Rugo Construction Co., Inc., Boston, for construction at a military installation in Middlesex County, to cost in excess of one million dollars. This work is to be supervised by the Boston district office of the Corps of Engineers.

Priority Rules for Canada Given in Reg. 22

Washington

● ● ● **Basic rules governing** the issuance of preference ratings and allotments for deliveries to be made into the Dominion of Canada have been issued by the WPB. These rules are contained in Priorities Regulation No. 22.

Ratings and allotments for such deliveries will be authorized by the WPB only upon the recommendation of the Priorities Officer of the Department of Munitions and Supply in Canada.

A standard form of certification appears in the regulation. This form is used in all cases where preference ratings and allotments are used in connection with deliveries to Canada. The regulation also informs suppliers of treatment to be accorded such orders.

Safe—even when he forgets

A busy day . . . short of help . . . shipments overdue . . . sometimes a worker forgets to be careful. With "A.W." Rolled Steel Floor Plate he's safe even when he's rushed. Guards against costly falling accidents. Permanently skid-proof. Toughest wear will not damage it. Ends floor troubles for good. "A.W." Floor Plate protects workers in industrial plants, refineries, railroads and on shipboard. Floor Plate Folder on request.

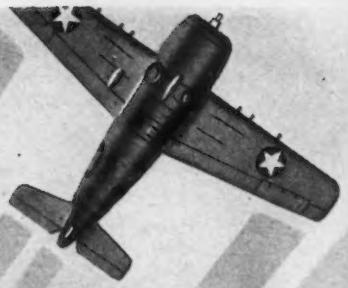
Other products include Plates, Sheets, Billets, Blooms, Slabs—Carbon, Copper or Alloy analyses.

ALAN WOOD STEEL COMPANY

MAIN OFFICE AND MILLS: CONSHOHOCKEN, PENNSYLVANIA : SINCE 1826. District Offices and Representatives: Philadelphia, New York, Boston, Atlanta, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, St. Paul, New Orleans, Pittsburgh, Roanoke, Sanford, N. C., St. Louis, Los Angeles, San Francisco, Seattle, Montreal.

NAMES THAT *Spotlight*

AMERICAN AIRCRAFT MOTOR SUPREMACY . . .



ALLISON
CONTINENTAL
PRATT & WHITNEY
RANGER
ROLLS-ROYCE
WRIGHT-AERONAUTICAL

BUICK
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DODGE-CHRYSLER
NASH
PACKARD
STUDEBAKER

WESSON
Carbide Cutting Tools
The name to rely on . . . no matter how tough the metal . . . for special or standard jobs . . . single or multiple setups.

Content with nothing less than precision to the nth degree . . . these names point the spotlight of world-wide supremacy on the American aircraft motors of today.

And the name WESSON spotlights the Carbide Cutting Tools that helped such leaders tool up for this undreamed of production.

Today, these manufacturers have the job licked . . . are far out in front on what was once considered an "impossible" schedule . . . the world's greatest achievement in organized precision production, in which WESSON is proud to have had an important part.

Today WESSON engineers, skilled in engineering and production of cutting tools, are combining their "know how" with "can do" action in tooling up to help solve present war production problems as well as in post-war planning.

WESSON CO. DETROIT, MICH. (Ferndale Station)

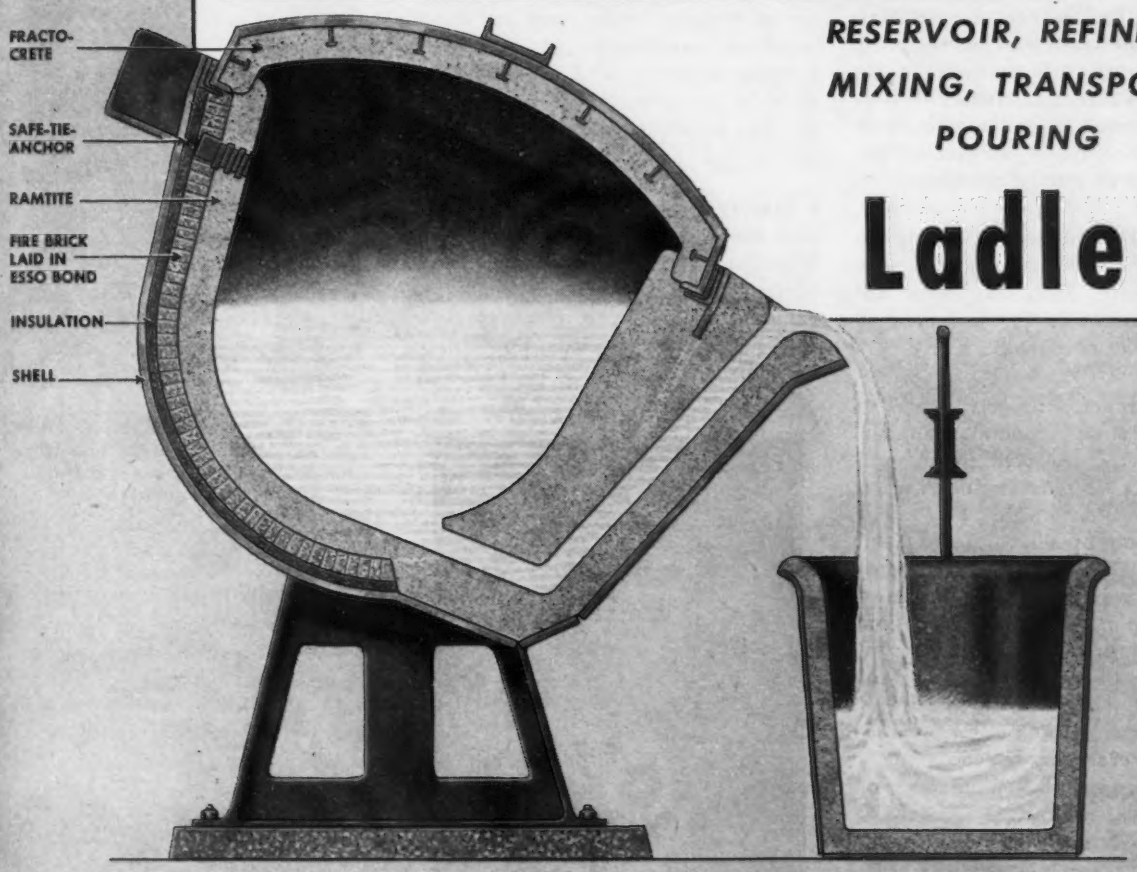
WHEN THE LIGHTS GO ON AGAIN all over the world, war-acquired precision will turn spotlights on those manufacturers who apply the benefits gained by using WESSON Carbide Cutting Tools . . . to machine the modern tougher metals better, at less cost . . . with fewer, simpler set-ups . . . with bigger bites of metal at greater speeds . . . with greater precision, finer finishes . . . for the good of all humanity and a better world in which to enjoy Peace!

RAMTITE PRODUCTS SERVE EVERY INDUSTRY USING HEAT

JUST THE RIGHT REFRACTORY FOR

RESERVOIR, REFINING, MIXING, TRANSPORT, POURING

Ladles



RAMTITE PRODUCTS

Ramtite Plastic Refractory ... in three grades

Fracto-Crete and Mono-Cast castable refractories

Esso Bond air set refractory mortar

Hott-Patch heat set refractory mortar

Esso (silicon carbide base) patching and ramming mixes

Safe-tie Refractory Anchors

RAMTITE is ideal for lining ladles because (1) it is installed in plastic form and is easily shaped to the proper contour, (2) its smooth, dense, monolithic surface prevents metal penetration, thus prolonging the life of the lining, (3) the unusual insulating quality keeps the metal at the right temperature for a longer period, (4) it is quickly and easily installed by ordinary plant labor, (5) the safe-tie refractory anchor ties the material to the ladle shell, (6) it has an exceptional combination of engineering properties.

Note the lining construction of the mixing ladle. A permanent fire brick lining separates the Ramtite and insulation, making the entire thickness of Ramtite lining usable. The construction permits repairing or replacing the Ramtite lining without damaging the insulation. This is a typical example of Ramtite products installed in all types of ladles with capacities from 100 pounds to 75 tons.

Send for a bulletin describing the engineering properties of Ramtite.

THE RAMTITE CO..... *Division of The S. Obermayer Co.*
1805 SOUTH ROCKWELL STREET, CHICAGO 8, ILLINOIS

RAMTITE

PLASTIC REFRACTORY

PERSONALS

• **James G. Kellogg** was elected president of the Kellogg Switchboard & Supply Co., Chicago, to succeed **Maj. Maurice K. McGrath** who has resigned. Major McGrath will continue in his capacity as a director. **James H. Kellogg** was elected executive vice-president of the company, succeeding his father who was elected president.

• **Stephen B. Mambert,** formerly an executive of the Kingsbury Ordnance Plant, LaPorte, Ind., has been appointed assistant to the president of Republic Aviation Corp.

• **K. C. Gardner,** formerly executive vice-president and general manager, has been elected president and general manager of United Engineering & Foundry Co., Pittsburgh. **F. C. Biggert,** a former president of the company, who had been serving as a vice-president, has been made chairman of the board, a newly created position. **John L. Young,** formerly manager of machinery sales, was elected vice-president in charge of industrial research. **George V. Lang,** a former secretary and terasurer, has been made treasurer, a director and member of the executive committee. **Carl T. Zinsmeister,** formerly assistant secretary and assistant treasurer, was elected secretary. **C. W. Rebhun** was made assistant secretary, and **E. S. Ward** assistant treasurer.

K. C. GARDNER, president and general manager of United Engineering & Foundry Co., Pittsburgh.

• **Walter L. Price,** assistant comptroller in charge of revenue accounts has been appointed comptroller of the Baltimore & Ohio Railroad Co. **J. W. Myers,** general accountant, was appointed assistant comptroller in charge of general accounts. **C. L. Cole,** auditor of freight traffic, was appointed assistant comptroller in charge of revenue accounts. **J. I. Barnes,** chief clerk to vice-president and comptroller, was appointed assistant to comptroller.

• **Stanley B. Amidon,** for many years with the American Steel & Wire Co., Worcester, and recently with the Steel Section WPB, has been appointed manager of the New England division of Charles Dreifus Co., Philadelphia.

ROBERT B. McCOLL, recently elected a member of the board of directors, American Locomotive Co., New York.

• **Robert B. McColl,** vice-president of manufacturing, American Locomotive Co., was recently elected a director of the company. Mr. McColl joined the American Locomotive Co. in 1922. He has held a number of executive positions among which were those of president of the McIntosh & Seymour Corp., and Alco Products, Inc., both divisions of American Locomotive.

• **Thomas L. Moore,** formerly a special assistant to the chief, Alloy Steel Branch, Steel Division, WPB, and later West Coast representative for the whole Steel Division, has resigned his appointment to resume his duties with Rustless Iron & Steel Corp., Baltimore. Mr. Moore will be district manager on the Pacific Coast.

STUART N. HUTCHISON, JR., recently elected member of the board of directors, Pittsburgh Steel Co., Pittsburgh.

• **Stuart Nye Hutchison, Jr.,** has been elected to the board of directors of Pittsburgh Steel Co., filling the vacancy caused by the death of George T. Ladd. Mr. Hutchison is a member of the law firm of Reed, Smith, Shaw & McClay.

• **J. M. Johns** has been appointed general manager of industrial sales of Libbey-Owens-Ford Glass Co. Recently he has been assistant to the vice-president in charge of sales.

• **Ralph E. Kruck** has been appointed manager of the product design department of the Westinghouse Electric Appliance Div., Westinghouse Electric & Mfg. Co. Before assuming his new position Mr. Kruck was a member of the engineering department at the Westinghouse East Springfield, Mass., plant. **Anthony Naiden** was appointed to succeed him at that plant.

• **Morgan C. Monroe** has been made director of industrial relations of the Farmingdale Div., Republic Aviation Corp. Mr. Monroe joined Republic Aviation in 1942 as employment manager, later becoming assistant industrial relations director. He succeeds **William L. Wilson,** who resigned to become assistant to the president of Kellett Aircraft Corp., Philadelphia.

• **A. A. Handler,** chief forging engineer for the Aluminum Co. of America, was honored upon completion of his 25th year with the company recently. Mr. Handler has been manager of the Cleveland forge shop since 1921.

• **John M. Dolan** has been appointed general sales manager of the Le Roi Co., Milwaukee. He was formerly in charge of sales and engineering of the compressor division, Sullivan Machinery Co., Chicago.

• **John W. Ladd**, first vice-president of the Cherry-Burrell Corp., has been elected president to succeed **W. L. Cherry** who becomes chairman of the executive committee. **H. H. Cherry**, general manager of the Cedar Rapids, Iowa, plant, succeeds Mr. Ladd as first vice-president.

• **Renwick A. Ostendorf**, former automotive dealer, has been appointed Buffalo district manager of the SWPC.

DAVID A. NELSON, vice-president and general manager of the West Coast plant, Detroit Broach Co.

• **David A. Nelson** has joined the Detroit Broach Co. as vice-president and will be general manager of the West Coast plant in Beverly Hills, Cal.

Mr. Nelson, was formerly secretary-treasurer of the Colonial Broach Co. with which concern he had been associated for the past 18 years.

• **Fred T. Turner**, former Pittsburgh representative for Osborn Mfg. Co., and **Page A. Mead**, who has been representing Osborn in eastern New York state, have been transferred to Cleveland offices for special assignments. Replacing Mr. Turner in Pittsburgh will be **Presley Katz**, transferred from the Chicago territory. **Dean M. Boundy** takes Mr. Mead's place in eastern New York and **Lloyd H. Ross** succeeds Mr. Katz in Chicago.

• **Fred L. Wolf** has been appointed executive vice-president of the Ross-Tacony Crucible Co., Tacony, Pa. Mr. Wolf will resign as deputy director of the Mica-Graphite Division, Minerals Bureau, WPB, Nov. 2. He was associated for many years with the Ohio Brass Co., Mansfield, Ohio.

• **S. C. Snyder** has been appointed development engineer in research and technology department of Carnegie-Illinois Steel Corp. **C. W. Stoker** has been appointed development engineer in electrical sheet and strip division, the position formerly held by Mr. Snyder. **Joseph Luchansky** has been named supervisor of assorting standards on the staff of chief metallurgical engineer. He was formerly chief quality observer at their Irvin Works. **A. Roy Pafenbach**, formerly assistant metallurgist at the company's Gary Sheet and Tin Mills, Gary, Ind., has been appointed surveyor of testing standards, research and technology department.

• **Cecil L. Gibbs**, former assistant traffic manager of the Birmingham-Southern Railroad, Birmingham, has been appointed assistant traffic manager of the Tennessee Coal, Iron & Railroad Co., Birmingham.

• **Lawrence S. Martz** has been named assistant to the president of Micromatic Hone Corp., Detroit. Mr. Martz joined the Micromatic organization in 1934, and has served since in the engineering, sales engineering, publicity and technical service departments.

LAWRENCE S. MARTZ, assistant to the president of Micromatic Hone Corp., Detroit.

OBITUARY...

• **Magnus Forsberg**, father of H. S. Forsberg, who is president and founder of the Forsberg Mfg. Co., Bridgeport, Conn., died recently. Mr. Forsberg who was born in Norway of Swedish parentage, started his career of steelmaker at the age of nine, forging nails in his father's shop. He came to this country from Sweden in 1922, and was connected with the operating personnel of his son's factory until his retirement a few months ago.

• **L. M. Brown**, president, Crucible Electric Steel Co., Homestead, Pa., died Oct. 24. He organized the company about 13 years ago and has been president since that time. He is credited with having invented a special alloy steel, the production of which was started by the Crucible Electric Steel Co.

• **John D. Crawbuck**, head of John D. Crawbuck Co., Pittsburgh, died Oct. 16. A native of New York City, Mr. Crawbuck was president of Miller-Owen Electric Co., Pittsburgh, until 1926, when he started the Crawbuck Co.

• **Samuel Bowles King**, assistant secretary of Underwriters' Laboratories, Inc., died Oct. 25. Before joining Underwriters Laboratories, Inc., he was advertising manager of the Sullivan Machinery Co. He was 63 years of age.

• **Charles Wescott Gennet, Jr.**, vice-president of Sperry Rail Service, a division of Sperry Products, Inc., Hoboken, N. J., died Oct. 26.

• **Frederick Darlington**, pioneer electrical engineer, died at Great Barrington, Mass., Oct. 27. He was associated with William Stanley and George Westinghouse in pioneer work on the alternating current system, and for many years was consulting engineer for the Westinghouse Electric & Mfg. Co. Mr. Darlington retired in 1935. He was 76 years of age.

• **Rowland Campbell**, former president and chairman of the board of the old Reo Motor Car Co., and president of the Campbell Engineering Co., Appleton, Wis., died Oct. 19. He was 48 years of age.

• **Edgar Lyon**, president of Lyon, Conklin & Co. Inc., Baltimore, died on Oct. 14. He had been president of the company which was founded by his father since 1907.

MACHINE TOOLS

. . . News and Market Activities

High Speed Milling Symposium Set

• • • In the Oct. 14 issue of THE IRON AGE, reports of 32 tests carried on at West Coast aircraft plants on the high speed milling of high alloy steels and of aluminum alloys centered on new techniques that may well render present milling equipment obsolete. The subject is of such current interest that a symposium is being devoted to it at the Annual Meeting of the American Society of Mechanical Engineers, to be held at the Hotel Pennsylvania, New York, during the week of Nov. 29. On Monday evening, the following speakers will participate in the symposium and will give engineers the benefit of progress to date in this latest and most interesting development of metal removal:

Aluminum Co. of America, L. W. Kempf.
Bell Aircraft Co., Dr. Arthur A. Schwartz, chief tool research engineer.
Boeing Aircraft Co. (representative not yet named).
Brown & Sharpe Mfg. Co., B. P. Graves, director of engineering.
Carboloy Co., Fred W. Lucht and Einer Almdale.
Cincinnati Milling Machine Co., Hans Ernst, research engineer.
Consolidated Vultee Aircraft Corp., Wallace Brainard, supervisor of planning, Vultee Field Div.
Defiance Machine Works, Ralph G. Hummer, master mechanic.
Kearney & Trecker Corp., H. A. Frommelt, director of research.

No one yet has the complete answer, but many of the above have had considerable experience in high speed milling, which they will discuss.

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MRO Ratings May Be Used to Obtain Special Tools

Washington

• • • Any person who is eligible to purchase controlled materials for maintenance, repair and operating supplies under any WPB regulation or order may use the allotment number or symbol assigned by such regulation or order to buy controlled materials for special tooling for his own use or for the use of a tool maker in manufacturing such special tooling for him, even though the tooling is a Class B product, the WPB announced.

Special tooling is defined to mean, "any jig, die, mold, fixture or other tooling of a type which has only one special use, is not a standard product and is not produced for general sale by the manufacturer of the tooling." This ruling, contained in Direction 35 to CMP Regulation 1, permits tool makers to accept controlled materials from their customers to manufacture special tooling for them even though the tooling is a Class B product.

•

Foote Bros. Approve Renegotiation Adjustments

Chicago

• • • Renegotiation of the war contracts of Foote Bros. Gear & Machine Corp., Chicago, recently concluded for the fiscal year ended Oct. 31, 1942, has reduced net income for that year from the reported net of $1,414,453 to $686,133, William A. Barr, president of the company, stated in a letter mailed to stockholders recently. Net profit for the fiscal year ended Oct. 31, 1941, was reduced from $733,295 to $714,295.

Net sales, as reported by the company, were $5,800,716 and $18,368,180, respectively, for the years 1941 and 1942.

The Price Adjustment Board determined that approximately 4 per cent of the net sales for the fiscal year 1941 and approximately 75 per cent of the net sales for the fiscal year 1942 were subject to renegotiation, Mr. Barr said. The company had already made a voluntary retroactive price adjustment of $2,059,965 without prejudice to the right of the government to conduct renegotiations under the statute.

The board determined that further refunds of $50,000 for 1941 and $2,850,000 for 1942 were required of the company under the renegotiation statute and such determination was finally accepted. The further refunds were approved by the directors of Foote Bros. on Oct. 15, 1943.

Machine Tool Prices Unchanged

• • • Average prices of standard (non-specialty) machine tools were unchanged in the third quarter of this year from the second quarter, and the Bureau of Labor Statistics' index remained at 118 per cent of the August, 1939, level, where it has stood for over two years. In the past four years—since the outbreak of the war—the greatest increases, approximately 25 per cent, have taken place in the prices of shapers and radial drills. Increases of approximately 20 per cent have occurred in the prices of punch presses, engine lathes and grinding machines, while milling machines, screw machines and planers have increased more than 15 per cent. During this time boring mills increased in price 14 per cent and turret lathes and upright drills about 10 per cent.

RESPONSIBLE FOR EFFICIENT fighting vehicles, the men of the Royal Electrical and Mechanical Engineers Depot take their workshops forward into the firing line.

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Acres of ground and 5,000 men to cover... yet a key man is found as fast as you can say his name!

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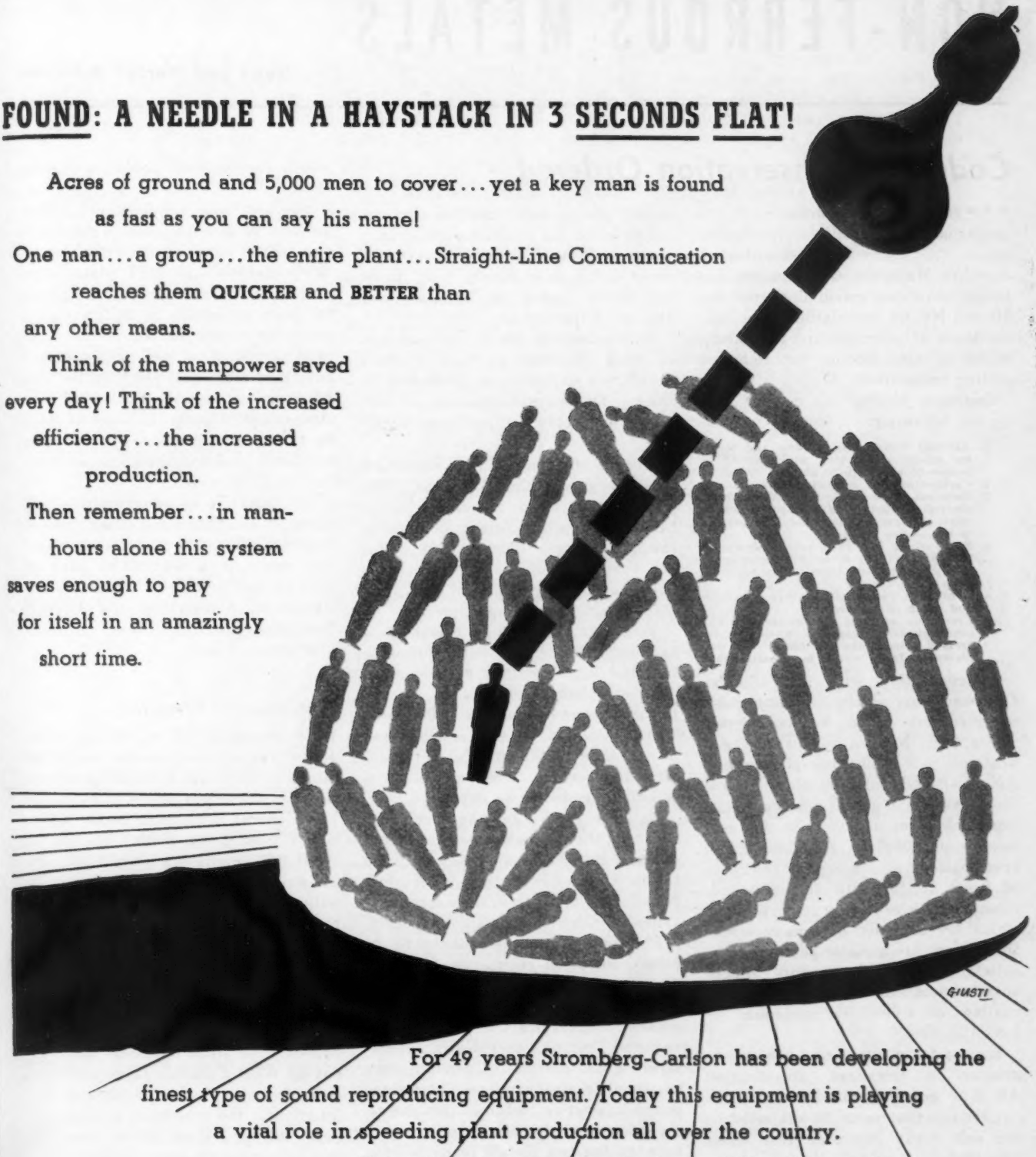
Think of the manpower saved every day! Think of the increased efficiency... the increased production.

Then remember... in man-hours alone this system saves enough to pay for itself in an amazingly short time.



For 49 years Stromberg-Carlson has been developing the finest type of sound reproducing equipment. Today this equipment is playing a vital role in speeding plant production all over the country.

If you have any communication problem that needs solving... why not get in touch with the Sound Systems Division of the Stromberg-Carlson Company, 100 Carlson Road, Rochester, New York. Write for free Booklet No. 1937.

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STRAIGHT-LINE COMMUNICATION SAVES MANPOWER • SPEEDS THE WORK TO VICTORY

NON-FERROUS METALS

. . . News and Market Activities

Cadmium Conservation Ordered

• • • **Because the cadmium** supply is inadequate to meet all future requirements, the Operating Committee on Aircraft Materials Conservation has issued two conservation directives, No. 5B and No. 6A pertaining to the conservation of cadmium and the substitution of zinc plating for cadmium plating respectively.

Cadmium plating can now be used for the following:

1. **Aircraft bolts, nuts, screws and washers except self-locking nuts limited by design to applications under 250 deg. F.**
2. **Carburetor and magneto parts.**
3. **External parts of engines for combat aircraft excluding attachments such as clips, clamps, and lugs not incorporated in the engine proper.**
4. **Parts which in service reach a temperature of 500 deg. F. or higher or come into contact with other parts reaching that temperature.**
5. **Parachute, safety belt, shoulder harness and bomb sling hardware.**
6. **Grounding contacts such as washers and other electrical contacts when the increased electrical resistance of zinc plated surfaces would be objectionable.**

In connection with any changes from cadmium to zinc, the applicable specifications must be considered. These Army-Navy-Aeronautical specifications, AN-P-32, zinc plating and AN-QQ-P-421, cadmium plating, have been revised and accept minimum plating thicknesses of 0.0003 in. for cadmium and 0.0005 in. for zinc. These specifications also accept a thickness of 0.002 in. for both zinc and cadmium on articles having integral parts which are threaded externally where the threads are a major portion of the article, and on parts where dimensional tolerances will not permit a coating of 0.0003 in. cadmium or 0.0005 in. zinc.

Except for platings of 0.0005 in. or greater in thickness, specification AN-P-32 covering zinc plating does not require that parts be subjected to the salt spray corrosion test when zinc plated.

Cadmium Plating

• • • **Cadmium can now** be electroplated on base metals in coats more than 50 times as thick as those normally deposited, the Electroplating Division of E. I. du Pont de Nemours & Co. has disclosed.

Cadmium, one of the most effective coatings to prevent corrosion of steel or iron, is being plated in heavier coats on steel sheets, for use on materials for war production. Du Pont cadmium anodes and "Cadalyte" cadmium plating salt produce the extreme corrosion resistance required.

Steel sheets 8 ft. long, over 2 ft. wide and approximately 1 in. thick, are being plated by Thomas-Thiel, Inc., of Wilmington.

Approximately 30 lb. of cadmium is being deposited on each of these sheets in a uniform coat about 0.02 in. thick. The normal thickness of cadmium electroplating has been 0.0003 in.

Anodes of pure cadmium metal are used along with the "Cadalyte" plating solution which is placed in the tank to a depth sufficient to immerse the steel plates. These heavy plates are suspended on the cathode racks and moved lengthwise in the tank throughout the plating processes.

To obtain the specified thickness of cadmium, 40 hr. of plating time is required in the bath for each sheet. The complete operation is accomplished in several stages. This was found necessary because sandblasting of the base metal surfaces left projections on which "trees" or spikes of cadmium tended to be deposited.

Between each stage the sheets are removed, the incipient trees are buffed off, and the sheets are then returned to the tanks for further processing. No effort is made to achieve a mirror-smooth finish on the completed sheets.

Plating in stages is thought to increase corrosion resistance. The effect of repeated immersions is to deposit the coating in laminations. In several laminations the possibility is removed that pits or holes in several layers would coincide. Cadmium electroplated on steel gives an added safeguard against corrosion at pits due to the fact that the electrolytic action between the two metals tends to protect the steel preferentially.

•

New Aircraft Specifications

• • • **Conservation directive** No. 6A on Army-Navy aeronautical specifications for 14S and 24S aluminum alloy products replaces conservation directive No. 6.

Specification AN-A-8 was prepared to introduce to the aircraft industry an extrusion alloy 14ST which in general possesses physical properties superior to those of 24ST extrusions and which can be extruded at a greater rate.

Specifications AN-A-12 and AN-A-13 were prepared mainly to guarantee the higher physical properties generally obtainable in 24ST plate, sheet and strip and thereby permit the use of these properties in design with a resultant weight saving in the pertinent airplanes as well as an overall saving of aluminum alloy. In the case of specification AN-A-13 additional strength is obtained in sheet of 0.064 in. thickness and greater by reducing the usual cladding thickness of 5 per cent to 2.5 per cent.

The directive as amended was prepared by the Operating Committee on Aircraft Materials Conservation and was approved on Sept. 22 by joint action of the Army Air Forces, Navy Bureau of Aeronautics and Aircraft Resources Control Office, Aircraft Production Board.

•

Procuring Ni Chemicals

• • • **Consumers of nickel** chemicals and nickel catalysts are no longer required to file Form WPB-287 to obtain supplies under provisions of Direction 1 to General Preference Order M-6-a, issued Nov. 1 by WPB. In lieu of WPB-287 purchasers should file end use and preference rating information with orders to the suppliers. The only form to be sent to WPB hereafter will be made out by the supplier.

•

Small Valves Eased

• • • **Order L-126,** Schedule III and Schedule IV were amended last Friday by WPB. Schedule III as amended corrects an error in a paragraph designation in the scheduled as amended Sept. 28. Schedule IV as amended makes certain changes in Lists A, C, D and E. Chief among these are:

The manufacture of water regulating valves of non-ferrous metal ¾ in. or smaller, is permitted. Suction pressure regulators are removed from the restrictions of the schedule. Two sizes of valves are added to the permitted sizes in Item 11 of List A. Sleeves, guides, packing nuts and adapters are added to the list of parts that may be made of non-ferrous metal for use in accessories itemized in List D. An additional size flare nut is included in Item 3 of List C.

REFINER, SMELTER PRICES

(Cents per lb. unless otherwise noted)

Aluminum, 99+%, del'd	15.00
Aluminum, No. 12 Fdy., (No. 2)	13.50
Aluminum, deoxidizing grades	12.50 to 13.75
Antimony, Asiatic, New York	Nominal
Antimony, American, f.o.b. Laredo, Tex.	14.50
Arsenic, prime white, 99%	4.00
Brass, 85-5-5-5 ingots (No. 115)	12.25
Cadmium, del'd	90.00
Cobalt, 97-99% (dollars per lb.)	$2.11
Copper, electro, Conn. Valley	12.00
Copper, electro, New York	11.75
Copper, lake	12.00
Copper, beryllium, 3.75-4.25% Be; dollars per lb. contained Be	$15.00
Gold, U. S. Treas., dollars per oz.	$35.00
Indium, 99.5%, dollars per troy oz.	$10.00
Iridium, dollars per troy oz.	$165.00
Lead, St. Louis	6.35
Lead, New York	6.50
Magnesium, 99.9+%, carlots	21.50
Magnesium, 12-in. sticks, carlots	30.00
Mercury, dollars per 76-lb. flask, f.o.b. shipping point or port of entry	$191 to $193.00
Nickel, electro	35.00
Palladium, dollars per troy oz.	$24.00
Platinum, dollars per oz.	$35.00
Silver, open market, New York, cents per oz.	44.75
Tin, Straits, New York	52.00
Zinc, East St. Louis	8.25
Zinc, New York	8.67

Copper, Copper Base Alloys

(Mill base, cents per lb.)

	Extruded Shapes	Rods	Sheets
Copper	20.87	....	20.87
Copper, H.R.	....	17.37	....
Copper, drawn	....	18.37	....
Low brass, 80%	....	20.40	20.15
High brass	....	....	19.48
Red brass, 85%	....	20.61	20.36
Naval brass	20.37	19.12	24.50
Brass, free cut	....	15.01	....
Commercial bronze, 90%	....	21.32	21.07
Commercial bronze, 95%	....	21.53	21.28
Manganese bronze	24.00	....	28.00
Phos. bronze, A, B, 5%	....	36.50	36.25
Muntz metal	20.12	18.87	22.75
Everdur, Herculoy, Olympic or equal	....	25.50	26.00
Nickel silver, 5%	....	28.75	26.50
Architect bronze	19.12	....	....

Aluminum

(Cents per lb., subject to extras on gage, size, temper, finish, factor number, etc.)

Tubing: 2 in. O.D. x 0.065 in. wall 2S, 40c. (½H); 52S, 61c. (O); 24S, 67½c. (T).

Plate: 0.250 in. and heavier: 2S and 3S, 21.2c.; 52S, 24.2c.; 61S, 22.8c.; 24S, 24.2c.

Flat Sheet: 0.188 in. thickness: 2S and 3S, 22.7c. a lb.: 52S, 26.2c.; 61S, 24.7c.; 24S, 26.7c.

2000-lb. base for tubing; 30,000-lb. base for plate, flat stock.

Extruded Shapes: "As extruded" temper; 2000-lb. base. 2S and 3S, factor No. 1 to 4, 25.5c.; 14S, factor No. 1 to 4, 35c.; 17S, factor No. 1 to 4, 31c.; 24S, factor No. 1 to 4, 34c.; 53S, factor No. 1 to 4, 28c.; 61S, factor No. 1 to 4, 28½c.

The factor is determined by dividing perimeter of shape by weight per lineal foot.

Wire, Rod and Bar: Base price; 17ST and 11ST-3, screw machine stock. Rounds: ¼ in., 28½c. per lb.; ½ in., 26c.; 1 in., 24½c.; 2 in., 23c. Hexagonals: ¼ in., 34½c. per lb.; ½ in., 28½c.; 1 in., 25½c.; 2 in., 25½c. 2S, as fabricated, random or standard lengths, ¼ in., 34c. per lb.; ½ in., 25c.; 1 in., 24c.; 2 in., 23c. 24ST, rectangles and squares, random or standard lengths, 0.093-0.187 in. thick by 1.001-2.000 in. wide, 33c. per lb.; 0.751-1.500 in. thick by 2.001-4.000 in. wide, 29c.; 1.501-2.000 in. thick by 4.001-6.000 in. wide, 27½c.

Magnesium

Sheet, rod, tubes, bars, extruded shapes subject to individual quotation. Metal turnings: 100 lb. or more, 46c. a lb.; 25 to 90 lb., 56c.; less than 25 lb., 66c.

NON-FERROUS SCRAP METAL QUOTATIONS

(OPA basic maximum prices, cents per lb., f.o.b. point of shipment, subject to quality, quantity and special preparation premiums)

Copper, Copper Base Alloys

OPA Group 1

No. 1 wire, No. 1 heavy copper	9.75
No. 1 tinned copper wire, No. 1 tinned heavy copper	9.75
No. 2 wire, mixed heavy copper	8.75
Copper tuyeres	8.75
Light copper	7.75
Copper borings	9.75
Lead covered copper wire, cable	6.00*
Lead covered telephone, power cable	6.04
Insulated copper	5.10*

OPA Group 2

Bell metal	15.50
High grade bronze gears	13.25
High grade bronze solids	11.50*
Low lead bronze borings	11.50*
Babbitt lined brass bushings	13.00
High lead bronze solids	10.00*
High lead bronze borings	10.00*
Red trolley wheels	10.75
Tinny (phosphor bronze) borings	10.50
Tinny (phosphor bronze) solids	10.50
Copper-nickel solids and borings	9.25
Bronze paper mill wire cloth	9.50
Aluminum bronze solids	9.00
Soft red brass (No. 1 composition)	9.00
Soft red brass borings (No. 1)	9.00
Gilding metal turnings	8.50
Unlined standard red car boxes	8.25
Lined standard red car boxes	7.75
Cocks and faucets	7.75
Mixed brass screens	7.75
Red brass breakage	7.50
Old nickel silver solids, borings	6.25
Copper lead solids, borings	6.25
Yellow brass castings	6.25

OPA Group 3

Yellow brass soft sheet clippings	8.625
Yellow rod brass turnings	8.375
Zincy bronze borings	8.00
Zincy bronze solids	8.00
Fired rifle shells	8.25
Brass pipe	8.00
Old rolled brass	7.75
Admiralty condenser tubes	8.00
Muntz metal condenser tubes	7.50
Plated brass sheet, pipe reflectors	7.50
Manganese bronze solids	7.25[1]
Manganese bronze solids	6.25[2]
Manganese bronze borings	6.50[1]
Manganese bronze borings	5.50[2]

OPA Group 4

Automobile radiators	7.00

OPA Group 5

Refinery brass	5.00*

*Price varies with analysis. [1] Lead content 0.00 to 0.40 per cent. [2] Lead content 0.41 to 1.00 per cent.

Aluminum

Plant scrap, segregated

2S solids	9.00
All other solids	8.50
Borings and turnings	
W'rt alloys (17S, 18S, 32S, 52S)	7.50
High grade alloys	7.00
Low grade alloys	6.50

Plant scrap, mixed

All solids	7.50
Borings and turnings	5.50

Obsolete scrap

Pure cable	9.00
Old sheet and utensils	7.50
Old castings and forgings	8.00
Pistons, free of struts	8.00
Pistons, with struts	6.00
Old alloy sheet	7.00

For old castings and forgings, pistons, sheets, add ½c. lb. for lots 1000 to 19,999 lb.; for other scrap add 1c.; for lots over 19,999 lb. add 1½c. a lb.

Magnesium

Segregated plant scrap

Pure solids and all other solids, exempt	
Borings and turnings	8.00

Mixed, contaminated plant scrap

Grade 1 solids	11.00
Grade 1 borings and turnings	7.00
Grade 2 solids	9.00
Grade 2 borings and turnings	5.00

For lots over 1499 lb. add 1c. per lb.

Zinc

New zinc clippings, trimmings	7.25
Engravers', lithographers' plates	7.25
Old zinc scrap	5.75
Unsweated zinc dross	5.80
Die cast slab	5.80
New die cast scrap	4.95
Radiator grilles, old and new	4.95
Old die cast scrap	4.50

Lead

Deduct 0.55c. a lb. from refined metal basing point prices for soft and hard lead inc. cable, for f.o.b. point of shipment price.

Nickel

Ni content 98+%, Cu under ½%, 26c. per lb.; 90 to 98% Ni, 26c. per lb. contained Ni.

ELECTROPLATING ANODES AND CHEMICALS

Anodes

(Cents per lb., f.o.b. shipping point)

Copper: Cast, elliptical, 15 in. and longer	25⅛
Electrolytic, full size	22⅞
cut to size	30⅛
Rolled, oval, straight, 15 in. and longer	23¼
Curved	24¼
Brass: Cast, 82-20, elliptical, 15 in. and longer	23¾
Zinc: Cast, 99.99, 16 in. and over	16¼
Nickel: 99% plus, cast	47
Rolled, depolarized	48
Silver: Rolled, 999 fine per Troy (1-9) oz., per oz.	58

Chemicals

(Cents per lb., delivery from New York)

Copper cyanide, tech., 100-lb. bbls. 1-5	5.65
Copper sulphate, 99.5 crystals, bbls.	13.00–13.50
Nickel salts, single, 425-lb. bbls.	34.00
Silver cyanide, 100 oz. lots	40.82–41.125
Sodium cyanide, 96% dom., 100-lb. dms.	0.15
Zinc cyanide, 100-lb. dms.	33.00
Zinc sulphate, 89% crystals, bbls.	6.80

SCRAP

. . . News and Market Activities

Market Slow; Alloy Solution Offered

• • • **Scrap supplies,** except for local differences, seem to be actually little different than they have been for a number of months despite much publicity in an effort to drive the public into a new wave of patriotic collections. Many localities report slow movement, little heavy buying is being recorded by the mills and collections are about as bad as they have been since the retirement of the peddler. The scrap drive has been producing results but reports so far indicate that these may not be very far reaching.

One reason being widely advanced for the poor showing so far with the scrap drive is that expectations of an early end to the war are causing many people to let down on such strictly patriotic endeavors. The lifting of the blackout regulations and encouraging war news has been reflected in many lines of war endeavor and may not be the morale builder they were intended to be.

One of the most troublesome scrap problems today is a huge accumulation of alloy solids and turnings which are begging for a buyer. Part of this accumulation is reported to have backed because of cutbacks in several war programs ordinarily calling for alloy steel and requiring heavy alloy scrap tonnages. Another factor, which is said to be taking an effect is the recent WPB directive removing the manufacture of alloy steel from the open hearth to the electric furnaces.

Several sections report alloy turnings are going without a bidder and the three-way-solids are faring little better. Part of the original difficulty in moving alloy scrap was the question of pure segregation. However, this problem is believed to have been mostly solved. Now all that is needed is a market. Some metalworking plants that generate alloy scrap are said to be selling to dealers well below OPA ceilings in order to move it. The alloy premiums also are being forgotten, it is reported.

Whatever answer may be found for the dilemma it appears that WPB will be forced to develop it as neither the mills nor the scrap dealers seem inclined to be caught with excessive inventories of alloy or any other type of scrap. At most, alloy scrap represents a small percentage of the total tonnages in the market and probably has drawn attention mainly through its nuisance value.

One very possible solution to finding a use for alloy scrap may develop from the creation of some new steel specifications which will permit the use of limited amounts of alloy scrap in the making of carbon steel, thereby forming what might be known as a mild alloy.

Some talk of using mild, alloy steels in construction work was mentioned at a recent convention of steel men and WPB has talked quite freely of broadening use of what it termed engineering alloys, presumably mild alloy steels having predominent carbon steel characteristics but also having some alloy content. Use of plain carbon steel is frequently dictated by price whereas a mild alloy would serve as well or better providing the cost could be absorbed. If WPB and OPA can work out a plan to use mild alloy steels in a number of plain carbon steel applications and not penalize the user with prices it seems likely that steelmakers could well use all the alloy scrap available.

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Faust Reports on Auto Graveyard Scrap

Washington

• • • **In announcing** the figures for scrap shipments from automobile graveyards for September, H. M. Faust, Director of the WPB Salvage Division, revealed an increase of approximately 11 per cent over August. Automobile wreckers shipped 96,490 tons of iron and steel scrap in September. This figure compares with 96,967 tons in July and 91,548 tons in June.

Mr. Faust stated that the automobile wreckers bought 61,850 cars in September. This is the highest figure since May, although it is still much lower than the goal set by WPB.

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BOSTON—A majority of yards report going along from day to day with nothing of special interest transpiring other than a slow gradual decrease in the weekly tonnage handled. It was decided the last minute the Massachusetts iron and steel salvage drive starting Armistice Day would be combined with waste paper, the paper collections to apply principally to towns and farms. Yards in general agreed to handle paper as well as metal scrap.

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BIRMINGHAM — Although the coal strike has resulted in an increased demand here for steel scrap, there is little flow of agricultural scrap into dealers' yards. With the peddler gone from the scrap market scene, there just isn't anybody to bring in this type of material.

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CINCINNATI—Dealers in this area report a modest slowing up in demand in the past week as result of recent rumor floating around the market of an early cessation of war needs. While, of course, most of this is unfounded, but as is typical in a sensitive market, it reacted almost immediately. Business, as a result, has been slow and dealers continue to complain on the lack of ample flow of material into the yards.

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BUFFALO—Only three boat loads of scrap have come down the lakes to Buffalo this year against an expected arrival of 15. This has resulted in a pronounced shortage in mills stocks, although the deficit has been offset to some extent by heavier barge canal shipments from seaboard. Total visible supply of scrap in district salvage yards and mill and foundry piles is unofficially calculated at 123,400 tons, a little less than 20 per cent of estimated annual consumption, but the distribution is such that the leading consumer stands in second place instead of first. Quality open hearth scrap remains tight.

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PHILADELPHIA — Shipments this week have declined, although the demand for carbon steel turnings has increased considerably because of the coal strike. Cast scrap continues to be scarce. WPB reports that scrap shipments from automobile graveyards in this area have increased 19 per cent in September over the previous month, but have declined almost 300 per cent from the same period last year. Car purchases by scrap yards are off 50 per cent this year and the number of cars to be dismantled are down 30 per cent.

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NEW YORK — Scrap situation continues here with little change. Carbon steel turnings for blast furnace use are in great demand because of the coal strike. Shipments continue light.

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PITTSBURGH — The scrap situation here remains tight, with blast furnace grades in heavy demand and with some plants attempting to make up pig iron loss by charging more scrap.

IRON AND STEEL (OTHER THAN RAILROAD) SCRAP

All Prices Are Per Gross Ton

	BASIC OPEN HEARTH GRADES		BLAST FURNACE GRADES				ELECTRIC FURNACE, ACID OPEN HEARTH AND FOUNDRY GRADES									
							Low Phos.		Heavy Structural and Plate			Foundry Steel				
Pittsburgh, Brackenridge, Butler, Monessen, Midland, Johnstown, Sharon, Canton, Steubenville, Warren, Youngstown, Weirton	No. 1 & 2 Hvy. Melt. No. 1 Co. Blk. Shts. No. 1 & 2 Bundles No. 1 Busheling	Unbaled* Machine Shop Turnings	Mixed Borings and Turnings	Cast Iron Borings	Shoveling Turnings	No. 2 Busheling	Billet, Bloom, Forge Crops	Bar Crops, Punchings Plate Scrap and Cast Steel	3 ft. and Under	2 ft. and Under	1 ft. and Under	2 ft. and Under	1 ft. and Under	Auto. Springs, and Crankshafts	Alloy Free Low Phos. and Sulphur Turnings	Heavy Axle and Forge Turn. First Cut	Electric Furnace Bundles
Pittsburgh, Brackenridge, Butler, Monessen, Midland, Johnstown, Sharon, Canton, Steubenville, Warren, Youngstown, Weirton	$20.00	$15.00	$15.00	16.00	$17.00	$17.50	$25.00	$22.50	$21.50	$22.00	$22.50	$21.50	$22.00	$21.00	$18.00	$19.50	$21.00
Cleveland, Middletown, Cincinnati, Portsmouth	19.50	14.50	14.50	15.00	16.50	17.00	24.50	22.00	21.00	21.50	22.00	21.00	21.50	20.50	17.50	19.00	20.50
Chicago, Claymont, Coatesville, Conshohocken, Harrisburg, Phoenixville, Sparrows Point	18.75	13.75	13.75	14.75	15.75	16.25	23.75	21.25	20.25	20.75	21.25	20.25	20.75	19.75	16.75	18.25	19.75
Ashland, Ky.	19.50	14.50	14.50	15.50	16.50	17.00	24.50	22.00	21.00	21.50	22.00	21.00	21.50	20.50	17.50	19.00	20.50
Buffalo, N. Y.	19.25	14.25	14.25	15.25	16.25	16.75	24.25	21.75	20.75	21.25	21.75	20.75	21.25	20.25	17.25	18.75	20.25
Bethlehem, Pa.; Kokomo, Ind.	18.25	13.25	13.25	14.25	15.25	15.75	23.25	20.75	19.75	20.25	20.75	19.75	20.25	19.25	16.25	17.75	19.25
Duluth, Minn.	18.00	13.00	13.00	14.00	15.00	15.50	23.00	20.50	19.50	20.00	20.50	19.50	20.00	19.00	16.00	17.50	19.00
Detroit, Mich.	17.88	12.85	12.85	13.85	14.85	15.35	22.85	20.35	19.35	19.85	20.35	19.35	19.85	18.85	15.85	17.35	18.85
Toledo, Ohio	....	12.85	12.85	13.85	14.85	15.35	....	....	....	....	....	....	....	....	....	....	....
St. Louis, Mo.	17.50	12.50	12.50	13.50	14.50	15.00	22.50	20.00	19.00	19.50	20.00	19.00	19.50	18.50	15.50	17.00	18.50
Atlanta, Ga.; Alabama City, Ala.; Birmingham, Los Angeles; Pittsburg, Cal.; San Francisco	17.08	12.00	12.00	13.00	14.00	14.50	22.00	19.50	18.50	19.00	19.50	18.50	19.00	18.00	15.00	16.50	18.00
Minnequa, Colo.	16.50	11.50	11.50	12.50	13.50	14.00	21.50	19.00	18.00	18.50	19.00	18.00	18.50	17.50	14.50	16.00	17.50
Seattle, Wash.	14.50	9.50	9.50	10.50	11.50	12.00	19.50	17.00	16.00	16.50	17.00	16.00	16.00	15.00	12.50	14.00	15.50

*Baled turnings are $5 per gross ton higher.

BUNDLES: Tin can bundles are $4 below dealers' No. 2 bundles No. 3 bundles are $2 less than No. 1 heavy melting.

AT NEW YORK CITY or Brooklyn, the maximum shipping point price is $15.33 for No. 1 heavy melting, f.o.b. cars, f.a.s. vessel or loaded on truck. Minimum set at $14 per grosston at any shipping point in U. S. Other grades carry differentials similar to those in table. New Jersey prices must be computed on basis of all-rail. At Boston the maximum is $15.05 for No. 1 f.o.b. cars, f.a.s. vessel or loaded on trucks. Shipments from a New England shipping point to a consumer outside New England carry maximum transportation charge of $6.66 per ton.

SWITCHING CHARGES: Deductions for shipping points within basing points (cents per gross ton) are: Pittsburgh, Brackenridge, 55c.; Midland, Johnstown, Sharon, Youngstown, Warren, Weirton, Cleveland, Toledo, Los Angeles, San Francisco, 42c.; Butler, Monessen, Canton, Steubenville, Cincinnati*, Portsmouth, Ashland, Coatesville, Harrisburg, Phoenixville, Bethlehem, Kokomo, Duluth, St. Louis, 28c.; Buffalo, Claymont, 36c.; Conshohocken, 11c.; Atlanta, Birmingham, 32c.; Pittsburg, Cal., 42c.; Middletown, 14c.; Sparrow's Point, 11c.; Chicago, 84c.; Detroit, 53c.; Alabama City, 26c.; Minnequa, 22c.; Seattle, 38c. *At Cincinnati, for basic open hearth grades, foundry steel and auto springs and crankshafts, deduct 80c. per ton.

PITTSBURGH basing point includes switching districts of Bessemer, Homestead, Duquesne, Munhall and McKeesport. Cincinnati basing point includes Newport, Ky., switching district. St. Louis includes switching districts of Granite City, East St. Louis, Madison, Ill. San Francisco includes switching districts of S. San Francisco, Niles and Oakmont, Cal. Claymont, Del., includes the switching point of Chester, Pa. Chicago includes Gary, Ind., switching district.

MAXIMUM SHIPPING POINT PRICE—Where shipment is by rail or vessel, or by combination of rail and vessel, the scrap is at its shipping point when placed f.o.b. railroad or f.a.s. vessel. In such cases, the maximum shipping point prices shall be: (a) For shipping points located within a basing point, the price listed in the table above for the scrap at the basing point in which the shipping point is located, minus the lowest established switching charge for scrap within the basing point and (b) for shipping points located outside the basing point, the price in table above at the most favorable basing point minus the lowest transportation charge by rail or water or combination thereof. In lieu of dock charge add 75c. a ton*, but 50c. if moved by deck scow or railroad lighter. Shipping by motor vehicle: The scrap is at its shipping point when loaded. For shipping points located within basing points take price listed in table minus applicable switching charge. If located outside a basing point, the price at the most favorable basing point minus lowest established charge for transporting by common carrier. If no established transportation rate exists, the customary costs are deducted. Published dock charges prevail. If unpublished include 75c.* For exceptions see official order.

UNPREPARED SCRAP: For unprepared scrap, maximum prices shall be $3.50 (and in the case of the material from which No. 1 No. 2, and No. 3 bundles are made $4) less maximum prices for the corresponding grade or grades of prepared scrap. In no case, however shall electric furnace and foundry grades be used as the "corresponding grade or grades of prepared scrap." Converter may charge $2.50 per ton on consumer-owned unprepared remote scrap (see order). A preparation-in-transit charge for allocated unprepared scrap is provided.

NEW LISTED GRADES: Priced in dollars per gross ton less than No. 1 heavy melting steel. Pit scrap, ladle skulls, slag reclaim, etc., of 85% or more Fe priced—$2; 75 to 85% Fe—$4; under 75% Fe—$8 per ton. Mill scale of 65% or more Fe—$8 per ton. Mill cinder and grindings, shipping point maximum price of $4 per gross ton at all U. S. shipping points.

CHEMICAL BORINGS: No. 1 (new, clean, containing not more than 1 per cent oil), $1 less than No. 1 heavy melting; No. 2 (new, clean containing not more than 1.5 per cent oil), $2 less than No. 1 heavy melting. If loaded in box cars add 75c.

*At Memphis 50c.; Great Lakes ports $1; New England $1.25.

RAILROAD SCRAP

	No. 1 RR Heavy Melting	Scrap Rails	Rails for Rerolling	Scrap Rails 3 ft. and Under	Scrap Rails 2 ft. and Under	Scrap Rails 18 in. and Under
Cleveland, Cincinnati, Ashland, Portsmouth Middletown	$20.50	$21.50	$23.00	$23.50	$23.75	$24.00
Canton, Pittsburgh, Sharon, Steubenville Wheeling, Youngstown	21.00	22.00	23.50	24.00	24.25	24.50
Chicago, Philadelphia, Sparrows Pt., Wilmington Birmingham, Los Angeles, San Francisco	19.75	20.75	22.25	22.75	23.00	23.25
Buffalo	18.00	19.00	20.50	21.00	21.25	21.50
Detroit	20.25	21.25	22.75	23.25	23.50	23.75
Duluth	18.85	19.85	21.35	21.85	22.10	22.35
Kansas City, Mo.	19.00	20.00	21.50	22.00	22.25	22.50
Kokomo, Ind.	17.00	18.00	19.50	20.00	20.25	20.50
Seattle	19.25	20.25	21.75	22.25	22.50	22.75
St. Louis	15.50	16.50	18.00	18.50	18.75	19.00
	18.50	19.50	21.00	21.50	21.75	22.00

CAST IRON SCRAP

	Group A	Group B	Group C
No. 1 cupola cast	$18.00	$19.00	$20.00
Clean auto cast	18.00	19.00	20.00
Unstripped motor blocks	15.50	16.50	17.50
Stove Plate	17.00	18.00	19.00
Heavy Breakable Cast	15.50	16.50	17.50
Charging Box Size Cast	17.00	18.00	19.00
Misc. Malleable	20.00	21.00	22.00

Group A includes the states of Montana, Idaho, Wyoming, Nevada, Utah, Arizona and New Mexico.

Group B includes the states of North Dakota, South Dakota, Nebraska, Colorado, Kansas Oklahoma, Texas and Florida.

Group C: States not named in A and B; switching district of Kansas City, Kan., Mo.

Tool Steel Scrap Ceiling Prices Set by MPR 379, May 4, 1943

BASE PRICE SEGREGATED

	Solids, Lb. Cont. W	Turnings, Lb. Cont. W
Type 1	$1.80	$1.60
Type 2	1.60	1.40
Type 3	1.25	1.25
Type 4*	0.125	0.105
Type 5*	0.135	0.115

*Per lb. of scrap material.

BASE PRICE UNSEGREGATED SOLIDS

$1.50 per lb. contained W if 5% or more.

$1.15 per lb. contained W if over 1% and less than 5%.

$0.80 per lb. contained Mo if 1½% or more.

BASE PRICE UNSEGREGATED TURNINGS

$1.30 per lb. contained W if 5% or more.

$1.00 per lb. contained W if 1% and less than 5%.

$0.70 per lb. contained Mo if 1½% or more

Comparison of Prices . . .

Advances Over Past Week in **Heavy Type**; Declines in *Italics*. [Prices Are F.O.B. Major Basing Points]

	Nov. 9, 1943	Nov. 2, 1943	Oct. 12, 1943	Nov. 10, 1942
Flat Rolled Steel: (Cents Per Lb.)				
Hot rolled sheets	2.10	2.10	2.10	2.10
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	2.10	2.10
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.10	2.10	2.10	2.10
Plates, wrought iron	3.80	3.80	3.80	3.80
Stain's c.r. strip (No. 302)	28.00	28.00	28.00	28.00
Tin and Terne Plate: (Dollars Per Base Box)				
Tin plate, standard cokes	$5.00	$5.00	$5.00	$5.00
Tin plate, electrolytic	4.50	4.50	4.50	4.50
Special coated mfg. ternes	4.30	4.30	4.30	4.30
Bars and Shapes: (Cents Per Lb.)				
Merchant bars	2.15	2.15	2.15	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless bars (No. 302)	24.00	24.00	24.00	24.00
Wrought iron bars	4.40	4.40	4.40	4.40
Wire and Wire Products: (Cents Per Lb.)				
Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.55
Rails: (Dollars Per Gross Ton)				
Heavy rails	$40.00	$40.00	$40.00	$40.00
Light rails	40.00	40.00	40.00	40.00
Semi-Finished Steel: (Dollars Per Gross Ton)				
Rerolling billets	$34.00	$34.00	$34.00	$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00
Wire Rods and Skelp: (Cents Per Lb.)				
Wire rods	2.00	2.00	2.00	2.00
Skelp (grvd)	1.90	1.90	1.90	1.90

	Nov. 9, 1943	Nov. 2, 1943	Oct. 12, 1943	Nov. 10, 1942
Pig Iron: (Per Gross Ton)				
No. 2 fdy., Philadelphia	$25.84	$25.84	$25.89	$25.89
No. 2, Valley furnace	24.00	24.00	24.00	24.00
No. 2, Southern Cin'ti	24.68	24.68	24.68	24.68
No. 2, Birmingham	20.38	20.38	20.38	20.38
No. 2, foundry, Chicago†	24.00	24.00	24.00	24.00
Basic, del'd eastern Pa.	25.39	25.39	25.39	25.39
Basic, Valley furnace	23.50	23.50	23.50	23.50
Malleable, Chicago†	24.00	24.00	24.00	24.00
Malleable, Valley	24.00	24.00	24.00	24.00
L. S. charcoal, Chicago	31.34	31.34	31.34	31.34
Ferromanganese‡	135.00	135.00	135.00	135.00
Scrap: (Per Gross Ton)				
Heavy melt'g steel, P'gh.	$20.00	$20.00	$20.00	$20.00
Heavy melt'g steel, Phila.	18.75	18.75	18.75	18.75
Heavy melt'g steel, Ch'go	18.75	18.75	18.75	18.75
No. 1 hy. comp. sheet, Det.	17.85	17.85	17.85	17.85
Low phos. plate, Youngs'n	22.50	22.50	22.50	22.50
No. 1 cast, Pittsburgh	20.00	20.00	20.00	20.00
No. 1 cast, Philadelphia	20.00	20.00	20.00	20.00
No. 1 cast, Ch'go	20.00	20.00	20.00	20.00
Coke, Connellsville: (Per Net Ton at Oven)				
Furnace coke, prompt	$6.50	$6.50	$6.50	$6.00
Foundry coke, prompt	7.50	7.375	6.875	6.875
Non-Ferrous Metals: (Cents per Lb. to Large Buyers)				
Copper, electro., Conn.	12.00	12.00	12.00	12.00
Copper, Lake, New York	12.00	12.00	12.00	12.00
Tin (Straits), New York	52.00	52.00	52.00	52.00
Zinc, East St. Louis	8.25	8.25	8.25	8.25
Lead, St. Louis	6.35	6.35	6.35	6.35
Aluminum, Virgin, del'd.	15.00	15.00	15.00	15.00
Nickel, electrolytic	35.00	35.00	35.00	35.00
Magnesium, ingot	20.50	20.50	20.50	22.50
Antimony (Asiatic), N. Y.	16.50	16.50	16.50	16.50

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton.
‡For carlots at seaboard.

The various basing points for finished and semi-finished steel are listed in the detailed price tables, pages 137-149.

Composite Prices . . .

	FINISHED STEEL	PIG IRON	SCRAP STEEL
Nov. 9, 1943	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One week ago	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One month ago	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One year ago	2.26190c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton

	FINISHED STEEL HIGH	FINISHED STEEL LOW	PIG IRON HIGH	PIG IRON LOW	SCRAP STEEL HIGH	SCRAP STEEL LOW
1943	2.25513c.,	2.25513c.,	$23.61	$23.61	$19.17	$19.17
1942	2.26190c.,	2.26190c.,	23.61	23.61	19.17	19.17
1941	2.43078c.,	2.43078c.,	$23.61, Mar. 20	$23.45, Jan. 2	$22.00, Jan. 7	$19.17, Apr. 16
1940	2.30467c., Jan. 2	2.24107c., Apr. 16	23.45, Dec. 23	22.61, Jan. 2	21.83, Dec. 30	16.04, Apr. 9
1939	2.35367c., Jan. 3	2.26689c., May 16	22.61, Sept. 19	20.61, Sept. 12	22.50, Oct. 3	14.08, May 16
1938	2.58414c., Jan. 4	2.27207c., Oct. 18	23.25, June 21	19.61, July 6	15.00, Nov. 22	11.00, June 7
1937	2.58414c., Mar. 9	2.32263c., Jan. 4	23.25, Mar. 9	20.25, Feb. 16	21.92, Mar. 30	12.67, June 9
1936	2.32263c., Dec. 28	2.05200c., Mar. 10	19.74, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June 9
1935	2.07642c., Oct. 1	2.06492c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, Apr. 29
1934	2.15367c., Apr. 24	1.95757c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	1.95578c., Oct. 3	1.75836c., May 2	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.89196c., July 5	1.83901c., Mar. 1	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	1.99626c., Jan. 13	1.86586c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.25488c., Jan. 7	1.97319c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.31773c., May 28	2.26498c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3

Weighted index based on steel bars, beams, tank plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing 78 per cent of the United States output. Index recapitulated in Aug. 28, 1941, issue.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

. . . Prices of Finished Iron and Steel

Steel prices shown here are f.o.b. basing points, in cents per lb., unless otherwise indicated. On some products either quantity deductions or quantity extras apply. In many cases gage, width, mutting, physical, chemical extras, etc., apply to the base price. Actual realized prices to the mill, therefore, are affected by extras, reductions, and in most cases freight absorbed to meet competition. Delivered prices do not reflect new 3 per cent tax on freight rates.

Basing Point → / Product ↓	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars	Pacific Ports, Cars[10]	DELIVERED TO Detroit	New York	Philadelphia
SHEETS															
Hot rolled	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.20¢	2.10¢		2.65¢	2.20¢	2.34¢	2.27¢
Cold rolled[1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢		3.70¢	3.15¢	3.39¢	3.37¢
Galvanized (24 ga.)	3.50¢	3.50¢	3.50¢		3.50¢	3.50¢	3.50¢	3.50¢	3.60¢	3.50¢		4.05¢		3.74¢	3.67¢
Enameling (20 ga.)	3.35¢	3.35¢	3.35¢	3.35¢			3.35¢		3.45¢	3.35¢		4.00¢	3.45¢	3.71¢	3.67¢
Long ternes[2]	3.80¢		3.80¢									4.55¢		4.16¢	4.12¢
STRIP															
Hot rolled[3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢		2.75¢	2.20¢	2.46¢	
Cold rolled[4]	2.80¢	2.90¢		2.80¢			2.80¢	(Worcester = 3.00¢)					2.90¢	3.16¢	
Cooperage stock	2.20¢	2.20¢			2.20¢		2.20¢							2.56¢	
Commodity C-R	2.95¢	3.05¢		2.95¢			2.95¢	(Worcester = 3.35¢)					3.05¢	3.31¢	
TIN MILL PRODUCTS															
Coke tin plate, base box	$5.00	$5.00	$5.00						$5.10					5.36¢	5.32¢
50 / .75 Electro tin plate, box	$4.50	$4.50	$4.50												
	$4.65		$4.65												
Black plate, 29 gage[5]	3.05¢	3.05¢	3.05¢						3.15¢			4.05¢[12]			3.37¢
Mfg. ternes, special box	$4.30	$4.30	$4.30						$4.40						
BARS															
Carbon steel	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢		(Duluth = 2.25¢)			2.50¢	2.80¢	2.25¢	2.49¢	2.47¢
Rail steel[6]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢					2.50¢	2.80¢			
Reinforcing (billet)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			2.50¢	2.55¢[13]	2.25¢	2.39¢	
Reinforcing (rail)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢				2.50¢	2.55¢[13]	2.25¢		2.47¢
Cold finished[8]	2.65¢	2.65¢	2.65¢	2.65¢		2.65¢			(Detroit = 2.70¢)					2.99¢	2.97¢
Alloy, hot rolled	2.70¢	2.70¢				2.70¢	(Bethlehem, Massillon, Canton = 2.70¢)						2.80¢		
Alloy, cold drawn	3.35¢	3.35¢	3.35¢	3.35¢		3.35¢							3.45¢		
PLATES								(Coatesville and Claymont = 2.10¢)							
Carbon steel	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	2.35¢		2.45¢	2.65¢	2.31¢	2.29¢	2.15¢
Floor plates	3.35¢	3.35¢									3.70¢	4.00¢		3.71¢	3.67¢
Alloy	3.50¢	3.50¢			(Coatesville = 3.50¢)						3.95¢	4.15¢		3.70¢	3.59¢
SHAPES															
Structural	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	(Bethlehem = 2.10¢)				2.45¢	2.75¢		2.27¢	2.215¢
SPRING STEEL, C-R															
0.26 to 0.50 Carbon	2.80¢			2.80¢			(Worcester = 3.00¢)								
0.51 to 0.75 Carbon	4.30¢			4.30¢			(Worcester = 4.50¢)								
0.76 to 1.00 Carbon	6.15¢			6.15¢			(Worcester = 6.35¢)								
1.01 to 1.25 Carbon	8.35¢			8.35¢			(Worcester = 8.55¢)								
WIRE[9]															
Bright[14]	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester = 2.70¢)					3.10¢			2.92¢
Galvanized	add proper size extra and galvanized extra to bright wire base, above.														
Spring (High Carbon)	3.20¢	3.20¢		3.20¢			(Worcester = 3.30¢)					3.70¢			3.52¢
PILING															
Steel sheet	2.40¢	2.40¢				2.40¢						2.95¢			2.72¢

[1] Mill run sheets are 10c per 100 lb. less than base; and primes only, 25c. above base. [2] Unassorted 8-lb. coating. [3] Widths up to 12 in. [4] Carbon 0.25 per cent and less. [5] Applies to certain width and length limitations. [6] For merchant trade. [7] Prices for straight length material only, from a producer to a consumer. Functional discount of 25c. per 100 lb. to fabricators. [8] Also shafting. For quantities of 20,000 to 29,999 lb. [9] Carload lot to manufacturing trade. [10] These prices do not apply if the customary means of transportation (rail and water) are not used. [12] Boxed. [13] Portland and Seattle price, San Francisco price is 2.50c. [14] This bright wire base price to be used in figuring annealed and bright finish wires, commercial spring wire and galvanized wire.

GOVERNMENT CEILING—Price Schedule No. 6 issued April 16, 1941, governs steel mill prices; Price Schedule No. 49 governs warehouse prices which are on another page of this issue.

EXCEPTIONS TO PRICE SCHEDULE No. 6—On hot rolled carbon bars, Phoenix Iron Co. may quote 2.35c. at established basing points, Calumet Steel division of Borg Warner may quote 2.35c., Chicago, on bars from its 8-in. mill; Joslyn Mfg. Co. may quote 2.35c., Chicago base. On rail steel bars Sweets Steel Co. may quote 2.35c., f.o.b. mill. On hot rolled sheets, Andrews Steel Co. may quote for shipment to Detroit area on Middletown base; Parkersburg Iron & Steel may quote $2.25 per hundred f.o.b. Parkersburg, W. Va. On galvanized sheets, Andrews Steel may quote 3.75c., at established basing points; Parkersburg Iron & Steel may quote $3.85 per hundred f.o.b. Parkersburg, W. Va. On hot rolled strip, Joslyn Mfg. Co. may quote 2.30c., Chicago base. On plates, Granite City Steel Co. may quote 2.35c., f.o.b. mill, and Central Iron & Steel Co. may quote 2.20c., f.o.b. basing points. On shapes, Phoenix Iron Co. may quote 2.30c. established basing points and 2.50c. Phoenixville for export.

On rail steel merchant bars, Eckels-Nye Corp. may charge 2.40c. On tubing, South Chester Tube Co. may price Gulf or Pacific Coast all-rail shipments and shipments west of Harrisburg on basis of f.o.b. Chester. On lend-lease sales to eastern seaboard, Sheffield Steel Co. and Colorado Fuel & Iron Corp. may sell f.o.b. mill. SEMIFINISHED STEEL—Follansbee Steel Corp. may sell forging billets at $40.50 f.o.b. Toronto; Continental Steel Corp. may sell Acme Steel Co. at $34 for rerolling billets plus extras and freight; Ford Motor Co. may sell rerolling billets at $34 f.o.b. Dearborn; Andrews Steel Co. may sell forging billets at $50 at established basing points and slabs at $41; Empire Sheet and Tin Plate may sell slabs at $41 at established basing points and sheet bars at $39 f.o.b. mill; on lend-lease sales Northwestern Steel & Wire Co. may charge $41 per gross ton f.o.b. mill for rerolling billets; on lend-lease sales Wheeling Steel Corp. may charge $36 per ton for small billets, f.o.b. Portsmouth and $37 per ton for sheet bars f.o.b. Portsmouth; Laclede Steel Co. on semi-finished sales for lend-lease shipped to eastern seaboard may use Chicago basing point prices f.o.b. Alton and Madison, Ill. ALLOY STEEL BARS—Texas Steel Co. may use Chicago base f.o.b. Fort Worth.

WAREHOUSE PRICES

(Delivered Metropolitan areas, per 100 lb. These prices do not necessarily apply for dislocated tonnage shipments when the f.o.b. City prices are used in conformance with OPA Schedule 19)

Cities	SHEETS			STRIP		Plates ¼ in. and heavier	Structural Shapes	BARS		ALLOY BARS			
	Hot Rolled (10 gage)	Cold Rolled	Galvanized (24 gage)	Hot Rolled	Cold Rolled			Hot Rolled	Cold Finished	Hot Rolled, NE 8617-20	Hot Rolled, NE 9142-45 Ann.	Cold Drawn, NE 8617-20	Cold Drawn, NE 9142-45 Ann.
Philadelphia	$3.518	$4.8725	$5.018	$3.922	$4.772	$3.805	$3.668	$3.882	$4.072		$7.116		
New York	3.590	4.6152	5.010	3.9746	4.771	3.768	3.758	3.853	4.103	$6.008	7.158	$7.303	$8.453
Boston	3.774	4.764	5.224	4.106	4.715	3.912	3.912	4.041	4.144	6.162	7.312	7.343	8.494
Baltimore	3.394	4.852	4.894	3.972	4.752	3.804	3.789	3.892	4.052	...	...	...	...
Norfolk	3.771	4.965	5.371	4.185	4.865	3.971	4.002	4.065	4.165	...	...	...	...
Washington	3.586	4.841	5.196	4.041	4.741	3.796	3.930	3.941	4.011	...	...	...	...
Chicago	3.25	4.20	5.234	3.60	4.678	3.55	3.55	3.50	3.75	5.75	6.90	8.85	8.00
Milwaukee	3.387	4.3372	5.2724	3.737	4.7878	3.687	3.687	3.637	3.887	5.987	7.137	7.087	8.237
Cleveland	3.35	4.40	4.8774	3.60	4.45	3.40	3.588	3.35	3.75	5.956	7.106	6.85	8.00
Buffalo	3.35	4.40	4.754	3.819	4.689	3.63	3.40	3.35	3.75	5.75	6.90	6.85	8.00
Detroit	3.45	4.50	5.004	3.70	5.9088	3.809	3.661	3.45	3.80	6.08	7.23	7.159	8.309
Cincinnati	3.425	4.4752	4.8281	3.675	4.711	3.611	3.691	3.611	4.011				
St. Louis	3.397	4.2472	5.1724	3.747	4.9318	3.697	3.697	3.647	4.031	6.131	7.281	7.231	8.381
Pittsburgh	3.35	4.40	4.75	3.60	4.45	3.40	3.40	3.35	3.75	5.75	7.15	6.85	8.25
St. Paul	3.51	4.46	5.2674	3.86	4.358	3.819	3.819	3.769	4.361	6.09	7.24	7.561	8.711
Omaha	3.865	5.443	5.6084	4.215		4.165	4.165	4.115	4.443				
Indianapolis	3.58	3.58	4.568	4.918	3.768	4.78	3.63	3.58	3.98	6.08	7.23	7.18	8.33
Birmingham	3.45		4.75	3.70		3.55	3.55	3.50	4.43				
Memphis	3.85	4.66	5.25	4.10		3.95	3.95	3.90	4.31	...	...	...	...
New Orleans	3.95	4.95	5.25	4.20		3.90	3.90	4.10	4.60	...	...	...	...
Houston	3.763	5.5732	6.313	4.313		4.25	4.25	3.75	6.3732	7.223	8.323	8.323	9.373
Los Angeles	5.00	7.202	6.104	4.95	5.613	4.95	4.65	4.40	5.583	8.304	9.404	9.404	10.454
San Francisco	4.55	7.304	6.354	4.50	7.3338	4.65	4.35	4.15	5.333	8.304	9.404	9.404	10.454
Seattle	...	...	...	...	...	...	...	...	...	...	...	...	...

NATIONAL EMERGENCY (N. E.) STEELS

(Hot Rolled Mill Extras for Alloy Content)

Designation	CHEMICAL COMPOSITION LIMITS, PER CENT								Basic Open-Hearth		Electric Furnace	
	Carbon	Manganese	Phosphorus Max.	Sulphur Max.	Silicon	Chromium	Nickel	Molybdenum	Bars and Bar Strip	Billets, Blooms and Slabs	Bars and Bar Strip	Billets Blooms and Slabs
NE 1330	.28/ .33	1.60/1.90	.040	.040	.20/ .35	.....	.....	.....	.10c	$2.00	.....	.....
NE 1335	.33/ .38	1.60/1.90	.040	.040	.20/ .35	.....	.....	.....	.10	2.00	.....	.....
NE 1340	.38/ .43	1.60/1.90	.040	.040	.20/ .35	.....	.....	.....	.10	2.00	.....	.....
NE 1345	.43/ .48	1.60/1.90	.040	.040	.20/ .35	.....	.....	.....	.10	2.00	.....	.....
NE 1350	.48/ .53	1.60/1.90	.040	.040	.20/ .35	.....	.....	.....	.10	2.00	.....	.....
NE 8613	.12/ .17	70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8615	.13/ .18	.70/ 90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ 25	.75	15.00	1.25	25.00
NE 8617	.15/ .20	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	15/ .25	.75	15.00	1.25	25.00
NE 8620	.18/ .23	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8630	.28/ .33	.70 .90	.040	.040	.20/ .35	.40/ .60	.40 .70	15 .25	.75	15.00	1.25	25.00
NE 8635	.33/ .38	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8637	.35/ .40	.75 1.00	.040	.040	.20/ .35	.40/ 60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8640	.38/ .43	.75 1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8642	.40/ .45	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ 25	.75	15.00	1.25	25.00
NE 8645	.43/ .48	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8650	.48/ .53	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8720	.18/ .23	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.20 .30	.80	16.00	1.30	26.00
NE 9255	.50/ .60	.70/ .95	.040	.040	1.80 2.20	.....	.....	.....	.40	8.00	.....	.....
NE 9260	.55/ .65	.70 1.00	.040	.040	1.80 2.20	.....	.....	.....	.40	8.00	.....	.....
NE 9261	.55/ .65	.70 1.00	.040	.040	1.80/2.20	.10/ .25	.....	.....	.65	13.00	.....	.....
NE 9262	.55/ .65	.70/1.00	.040	.040	1.80 2.20	.25/ .40	.....	.....	.65	13.00	.....	.....
NE 9415	.13/ .18	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	$25.00
NE 9420	.18/ .23	.80 1.10	.040	.040	.20/ .35	.30/ .50	.30/ 60	.08/ .15	.75	15.00	1.25	25.00
NE 9422	.20/ .25	.80/1.10	.040	.040	.20/ 35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9425	.23/ .28	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.03/ .15	.75	15.00	1.25	25.00
NE 9430	.28/ .33	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30 .60	.08/ .15	.75	15.00	1.25	25.00
NE 9435	.33/ .38	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9437	.35/ .40	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ 60	.08/ .15	.75	15.00	1.25	25.00
NE 9440	.38/ .43	.90/1.20	.040	.040	.20/ .35	.30/ 50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9442	.40/ .45	1.00/1.30	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.80	16.00	1.30	26.00
NE 9445	.43/ .48	1.00/1.30	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.80	16.00	1.30	26.00
NE 9450	.48/ .53	1.20/1.50	.040	.040	.20/ .35	.30/ .50	.30 .60	.08/ .15	.80	16.00	1.30	26.00
NE 9537*	.35/ .40	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40 .70	.15/ 25	1.20	24.00	1.70	34.00
NE 9540*	.38/ .43	1.20 1.50	.040	.040	.40 .60	.40 .60	40 .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9542*	.40/ .45	1.20 1.50	.040	.040	.40 .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9545*	.43/ .48	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9550*	.48/ .53	1.20/1.50	.040	.040	.40 .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00

BASE QUANTITIES: Hot rolled sheets, cold rolled sheets, hot rolled strip, plates, shapes and hot rolled bars, 400 to 1999 lb.; galvanized sheets, 150 to 1499 lb.; cold rolled strip, extras apply on all quantities; cold finished bars, 1500 lb. and over; NE alloy bars, 1000 lb. and over: Exceptions: [1] 500 to 1499 lb. [2] 400 to 1499 lb. [3] 400 to 3999 lb. [4] 450 to 1499 lb. [5] 1000 to 1999 lb. [6] 0 to 1999 lb. [7] 300 to 10,000 lb. [8] 2000 to 39,999 lb. [9] 400 to 14,999 lb. At Philadelphia galvanized sheets, 25 or more bundles; Boston, cold rolled and galvanized sheets, 450 to 3749 lb.; San Francisco, hot rolled sheets and strip, plates, shapes and hot rolled bars, 400 to 39,999 lb.; Seattle, cold finished bars, 1000 lb. and over, hot rolled alloy bars, 0-1999 lb.; Memphis, hot rolled sheets, 400 to 1999 lb. galvanized sheets, 150 and over; Los Angeles, cold rolled strip 1000 lb. and over. Houston, galvanized sheets, 150 to 499 lb. Extras for size, quality, etc., apply on above quotations.

Base delivered prices according to price zones established by Amendments to RPS 49.

***Recommended for large sections only. Note: The extras shown above are in addition to a base price of 2.70c. per 100 lb., on finished products and $54 per gross ton on semi-finished steel major basing points and are in cents per 100 lb. and dollars per gross ton in semi-finished. When acid open-hearth is specified and acceptable add to basic open hearth alloy differential 0.25c. per lb. for bars and bar strip, $5.00 per gross ton for billets, blooms and slabs. The ranges shown above are restricted to sizes 100 sq. in. or less or equivalent cross sectional area 18 in. wide or under with a max. individual piece weight of 7000 lb**

PRICES

CAST IRON WATER PIPE

	Per Net Ton
6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
6-in. and larger, Birmingham	46.00
6-in. and larger f.o.b. cars, San Francisco or Los Angeles	69.40
6-in. and larger f.o.b. cars, Seattle	71.20

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons or over, 6-in. and larger is $45 at Birmingham and $53.80 delivered Chicago, $59.40 at San Francisco and Los Angeles, and $70.20 at Seattle. Delivered prices do not reflect new 3 per cent tax on freight rates.

LAKE SUPERIOR ORES

(51.50% *Fe, Natural Content, Delivered Lower Lake Ports**)

	Per Gross Ton
Old range, bessemer, 51.50	$4.75
Old range, non-bessemer, 51.50	4.60
Mesaba, bessemer, 51.50	4.60
Mesaba, non-bessemer, 51.50	4.15
High phosphorus, 51.50	4.35

*Adjustments are made to indicate prices based on variance of Fe content of ores as analyzed on a dry basis by independent laboratories.

COKE

Furnace

	Per Net Ton
†Connellsville, prompt	$6.50*

Foundry

†Connellsville, prompt	7.50
Fayette County, W. Va. (Beehive)	8.10
By-product, Chicago	12.25
By-product, New England	13.75
By-product, Newark	12.40 to 12.95
By-product, Philadelphia	12.38
By-product, Cleveland	12.30
By-product, Cincinnati	11.75
By-product, Birmingham	8.50†
By-product, St. Louis	12.02
By-product, Buffalo	12.50

Maximum by-product coke prices established by OPA became effective Oct. 1, 1941.

*Hand-drawn ovens using trucked coal are permitted to charge $7.00 per net ton, plus usual transportation. Maximum beehive furnace coke prices established by OPA, Feb. 8, 1942. †F.o.b. oven.

FLUORSPAR

Maximum price f.o.b. consumer's plant, $30 per short ton plus either (1) rail freight from producer to consumer, or (2) rail freight from Rosiclare, Ill., to consumer, whichever is lower.

Exception

When the WPB Steel Division certifies in writing the consumer's need for one of the higher grades of metallurgical fluorspar specified in the table below the price shall be taken from the table plus items (1 and 2) from paragraph above.

Effective CaF_2 Content:	*Base price per short ton*
70% or more	$33.00
65% but less than 70%	32.00
60% but less than 65%	31.00
Less than 60%	30.00

REFRACTORIES

(F.o.b. Works)

Fire Clay Brick	*Per 1000*
Super-duty brick, St. Louis	$64.60
First quality, Pa., Md., Ky., Mo., Ill.	51.30
First quality, New Jersey	56.00
Sec. quality, Pa., Md. Ky., Mo., Ill.	46.55
Second quality, New Jersey	51.00
No. 1, Ohio	43.00
Ground fire clay, net ton	7.60
Silica Brick	
Pennsylvania and Birmingham	$51.30
Chicago District	58.80
Silica cement, net ton (Eastern)	9.00
Chrome Brick	*Per Net Ton*
Standard, chemically bonded, Balt., Plymouth Meeting, Chester	$54.00
Magnesite Brick	
Standard, Balt and Chester	$76.00
Chemically bonded, Baltimore	65.00
Grain Magnesite	
Domestic, f.o.b. Balt. and Chester in sacks (carloads)	$44.00
Domestic, f.o.b. Chewelah, Wash. (in bulk)	22.00

BRONZE BEARINGS
OILLESS BRONZE BEARINGS
GEAR BLANKS
MACHINED BRONZE PARTS

S & H Bronze Bearings can be furnished in any size or quantity to meet your particular requirements.

Our equipment and manufacturing methods enable us to meet the most exacting specifications and design.

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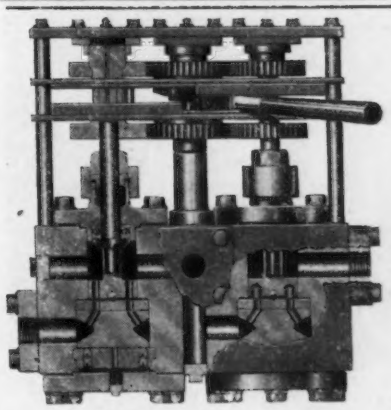
Cranford New Jersey



Reduce Maintenance Cost

HYDRA VENTURI-VACUUM VALVES

3 and 4 way straight operating or neutral point operating Valve

Hydra Venturi-Vacuum Valves are designed on a new scientific principle. There are no springs or cups to get out of order. The extreme ease and smoothness of operation also tends to hold down maintenance cost—as does the freedom from shock on the line when closing. Long trouble-free service is assured. Many installations in many industries support these facts.

2 way angle and straight through shut-off Valve

Write for descriptive folder and full information

ALBRIGHT EQUIPMENT CO.
FERNDALE, JOHNSTOWN, PA.

A.I.S.I. HY-TEN S.A.E.
N.E.

ALLOY STEELS FOR OFFENSE

Scientifically selected to conserve critical alloys and meet the requirements of the AIRCRAFT, ORDNANCE, and MACHINE TOOL industries.

Complete "EARMARKED" stocks of Aircraft alloy steels at Buffalo and Detroit.

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USE THIS HELP
to solve your materials handling problems . . .

This 16-page book, "Modern Materials Handling Magic", can give you the story of electric hoists that are "tailor made" to meet your specific plant conditions. Yet this *special equipment* costs no more than ordinary *standard equipment* installations.

Find out how the *Reading Unit Construction Plan* offers greater materials handling flexibility and real savings to users. Through this plan, any one of 144 different electric hoists can be provided to meet special plant needs—and each hoist is made of standard parts throughout.

Send today for your copy of this useful book. A note on your company letterhead is all that is needed to start your copy of "Modern Materials Handling Magic" on its way to your desk.

Reading Chain & Block Corporation, 2101 Adams St., Reading, Pa.

READING CHAIN HOISTS·ELECTRIC HOISTS OVERHEAD TRAVELING CRANES

PRICES

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Machine and Carriage Bolts:

	Per Cent Off List
½ in. & smaller x 6 in. & shorter	65½
9/16 & ⅝ in. x 6 in. & shorter	63½
¾ to 1 in. x 6 in. & shorter	61
1⅛ in. and larger, all length	59
All diameters over 6 in. long	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed:
(Hexagon or Square)

½ in. and smaller	62
9/16 to 1 in. inclusive	59
1⅛ to 1½ in. inclusive	57
1⅝ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 per cent for full container quantities. There is an additional 5 per cent allowance for carload shipments.

Semi-Fin. Hexagon Nuts	U.S.S.	S.A.E.
7/16 in. and smaller	..	64
½ in. and smaller	62	..
½ in. through 1 in.	..	60
9/16 to 1 in.	59	..
1⅛ in. through 1½ in.	57	58
1⅝ in. and larger	56	..

In full container lots, 10 per cent additional discount.

Stove Bolts

Packages, nuts loose	71 and 10
In packages, with nuts attached	71
In bulk	80

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago, New York on lots of 200 lb. or over.

Large Rivets *(½ in. and larger)*

	Base per 100 lb.
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	$3.75

Small Rivets *(7/16 in. and smaller)*

	Per Cent Off List
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	65 and 5

Cap and Set Screws

	Per Cent Off List
Upset full fin. hexagon head cap screws, coarse or fine thread, up to and incl. 1 in. x 6 in.	64
Upset set screws, cup and oval points	71
Milled studs	46
Flat head cap screws, listed sizes	36
Filister head cap, listed sizes	51

Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

RAILS, TRACK SUPPLIES

(F.o.b. Mill)

Standard rails, heavier than 60 lb., No. 1 O.H., gross ton	$40.00
Angle bars, 100 lb.	2.70
(F.o.b. Basing Points)	*Per Gross Ton*
Light rails (from billets)	$40.00
Light rails (from rail steel)	39.00
	Base per Lb.
Cut spikes	3.00c.
Screw spikes	5.15c.
Tie plates, steel	2.15c.
Tie plates, Pacific Coast	2.30c.
Track bolts	4.75c.
Track bolts, heat treated, to railroads	5.00c.
Track bolts, jobbers discount	63-5

Basing points, light rails—Pittsburgh, Chicago, Birmingham; spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo; spikes alone—Youngstown, Lebanon, Pa., Richmond.

ROOFING TERNE PLATE

(F.o.b. Pittsburgh, 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	$6.00	$12.00
15-lb. coating I.C.	7.00	14.00
20-lb. coating I.C.	7.50	15.00

PRICES

ELECTRICAL SHEETS

(Base, f.o.b. Pittsburgh)

	Per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
Motor	4.95c.
Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

F.o.b. Granite City, add 10c. per 100 lb. on field grade to and including dynamo. Pacific ports add 75c. per 100 lb. on all grades.

WIRE PRODUCTS

To the trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham

	Base per Keg
Standard wire nails	$2.55
Coated nails	2.55
Cutnails, carloads	3.85
	Base per 100 Lb.
Annealed fence wire	$3.05
Annealed galvanized fence wire	3.40
	Base Column
Woven wire fence*	67
Fence posts (carloads)	69
Single loop bale ties	59
Galvanized barbed wire†	70
Twisted barbless wire	70

*15½ gage and heavier. †On 80-rod spools in carload quantities.

WELDED PIPE AND TUBING

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills
(F.o.b. Pittsburgh only on wrought pipe)
Base Price—$200 per Net Ton

	Black	*Galv.*
Steel (Butt Weld)		
½ in.	63½	51
¾ in.	66½	55
1 to 3 in.	68½	57½
Wrought Iron (Butt Weld)		
⅛ in.	25	3½
¼ in.	30	10
⅜ and 1¼ in.	34	16
1½ in.	38	18½
2 in.	37½	18
Steel (Lap Weld)		
2 in.	61	49½
2½ and 3 in.	64	52½
3½ to 6 in.	66	54½
Wrought Iron (Lap Weld)		
2 in.	30½	12
2½ to 3½ in.	31½	14½
4 in.	33½	18
4½ to 8 in.	32½	17
Steel (Butt, extra strong, plain ends)		
½ in.	61½	50½
¾ in.	65½	54½
1 to 3 in.	67	57
Wrought Iron (Same as Above)		
½ in.	25	6
¾ in.	31	12
1 to 2 in.	38	19½
Steel (Lap, extra strong, plain ends)		
2 in.	59	48½
2½ and 3 in.	63	52½
3½ to 6 in.	66½	56
Wrought Iron (Same as Above)		
2 in.	33½	15½
2½ to 4 in.	39	22½
4½ to 6 in.	37½	21

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or $2 a ton higher on all butt weld.

ANY METAL • ANY PERFORATION

Industrial—Well balanced screens of excellent material and workmanship to assure maximum screen production combined with durability.

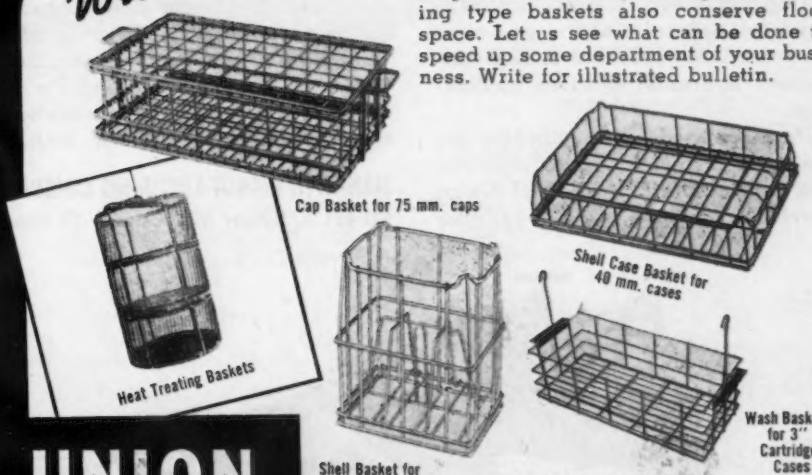
Ornamental—Approved patterns and finishes including many exclusive and characteristic designs for grilles and furniture. We invite your inquiries.

The Harrington & King PERFORATING CO.

5657 FILLMORE STREET—CHICAGO 44, ILL.
Eastern Office, 114 Liberty Street, New York 6, N. Y.

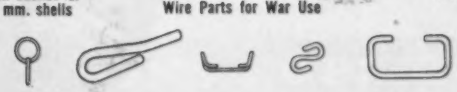
Faster "UNIT HANDLING" *With* WIRE BASKETS

● Union Steel Wire Baskets are being used in war plants to organize production—to handle complete lots in a basket as single units. The object is speed. Stacking type baskets also conserve floor space. Let us see what can be done to speed up some department of your business. Write for illustrated bulletin.


Cap Basket for 75 mm. caps
Shell Case Basket for 40 mm. cases
Heat Treating Baskets
Shell Basket for 75 mm. shells
Wash Basket for 3" Cartridge Cases

UNION STEEL Products

Wire Parts for War Use



These are only a few of the many wire parts being used for war purposes. Write, Wire or Phone (Albion, No. 147) for quotations or further information on Wire parts or products (woven, welded or formed).

UNION STEEL PRODUCTS COMPANY
442 Pine St., Albion, Michigan

PIG IRON

All prices set in bold face type are maxima established by OPA on June 24, 1941. Other domestic prices (in italics) are delivered quotations per gross ton computed on the basis of the official maxima. Delivered prices do not reflect 3 per cent tax on freight rates.

	No 2 Foundry	Basic	Bessemer	Malleable	Low Phosphorus	Charcoal
Boston††	*$25.50*	*$25.00*	*$26.50*	*$25.50*	.....	.....
Brooklyn	*27.50*	.....	.....	*28.00*	.....	.....
Jersey City	*26.53*	*26.03*	*27.53*	*27.03*	.....	.....
Philadelphia	*25.84*	*25.34*	*26.84*	*26.34*	*$30.74*	.....
Bethlehem, Pa.	25.00	24.50	26.00	25.50	.....	.....
Everett, Mass.††	25.00	24.50	26.00	25.50	.....	.....
Swedeland, Pa.	25.00	24.50	26.00	25.50	.....	.....
Steelton, Pa.	.....	24.50	.....	.....	29.50	.....
Birdsboro, Pa.	25.00	24.50	26.00	25.50	29.50	.....
Sparrows Point, Md.	25.00	24.50	.....	.....	.....	.....
Erie, Pa.	24.00	23.50	25.00	24.50	.....	.....
Neville Island, Pa.	24.00	23.50	24.50	24.00	.....	.....
Sharpsville, Pa.*	24.00	23.50	24.50	24.00	.....	.....
Buffalo	24.00	23.00	25.00	24.50	29.50	.....
Cincinnati, Ohio	*23.94*	*23.94*	.....	*25.11*	.....	.....
Canton, Ohio	*25.39*	*24.89*	*25.89*	*25.39*	*32.69*	.....
Mansfield, Ohio	*25.94*	*25.44*	*26.44*	*25.94*	*32.86*	.....
St. Louis	*24.50*	*24.50*	.....	.....	.....	.....
Chicago	24.00	23.50	24.50	24.00	*35.46*	.....*$31.34*
Granite City, Ill.	24.00	23.50	24.50	24.00	.....	.....
Cleveland	24.00	23.50	24.50	24.00	*32.42*	.....
Hamilton, Ohio	24.00	23.50	.....	24.00	.....	.....
Toledo	24.00	23.50	24.50	24.00	.....	.....
Youngstown*	24.00	23.50	24.50	24.00	*32.42*	.....
Detroit	24.00	23.50	24.50	24.00	.....	.....
Lake Superior fc.	.....	.....	.....	.....	.....	$34.00
Lyles, Tenn. fc.†	.....	.....	.....	.....	.....	33.00
St. Paul	*26.76*	.....	*27.26*	*26.76*	*39.80*	.....
Duluth	24.50	24.00	25.00	24.50	.....	.....
Birmingham	20.38	19.00	25.00	.....	.....	.....
Los Angeles	*26.95*	.....	.....	.....	.....	.....
San Francisco	*26.95*	.....	.....	.....	.....	.....
Seattle	*26.95*	.....	.....	.....	.....	.....
Provo, Utah	22.00	21.50	.....	.....	.....	.....
Montreal	*27.50*	*27.50*	.....	*28.00*	.....	.....
Toronto	*25.50*	*25.50*	.....	*26.00*	.....	.....

GRAY FORGE IRON: Valley or Pittsburgh furnace $23.50

*Pittsburgh Coke & Iron Co. (Sharpsville, Pa., furnace only) and the Struthers Iron and Steel Co., Struthers, Ohio, may charge 50c. a ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable.

**Pittsburgh Ferromanganese Co. (Chester furnace only) may charge $2.25 a ton over maximum basing point prices.

†Price shown is for low-phosphorous iron; high-phosphorous sells for $28.50 at the furnace.

††Eastern Gas & Fuel Associates, Boston, is permitted to sell pig iron produced by its selling company, Mystic Iron Works, Everett, Mass., at $2 per gross ton above maximum prices.

Delta Chemical & Iron Co., Chicago, may charge $30 for charcoal iron at its Delta, Mich., furnace.

Basing point prices are subject to switching charges; silicon differentials (not to exceed 50c. a ton for each 0.25 per cent silicon content in excess of base grade which is 1.75 per cent to 2.25 per cent); phosphorous differentials, a reduction of 38c. per ton for phosphorous content of 0.70 per cent and over; manganese differentials, a charge not to exceed 50c. per ton for each 0.50 per cent manganese content in excess of 1.00 per cent. Effective March 3, 1943, $2 per ton extra may be charged for 0.5 to 0.75 per cent nickel content and $1 per ton extra for each additional 0.25 per cent nickel.

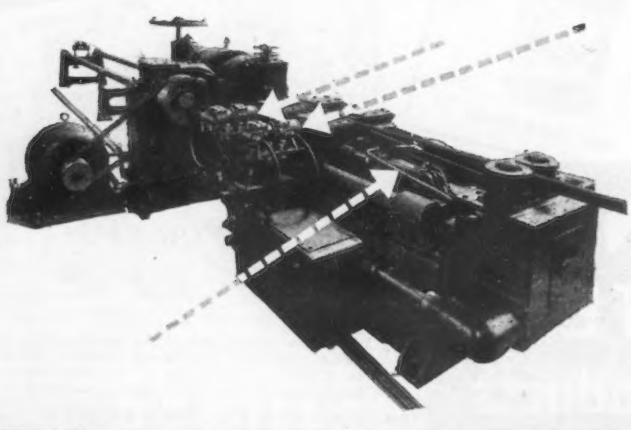
HANNIFIN *hydraulic* CYLINDERS

provide positive control of clamps

In this Medart Centerless Bar Turning Machine, Hannifin Hydraulic Cylinders are used to operate several clamping mechanisms. Smooth, powerful hydraulic action and simple control are provided in this convenient hydraulic cylinder application.

Hannifin hydraulic cylinders are designed to meet modern machine tool requirements. No-tie-rod design provides a stronger, simpler cylinder and easier application. Hannifin boring and honing, even in the largest sizes, produce a straight, round, mirror finished cylinder bore, assuring efficient piston seal with minimum fluid slip and maximum power. Built in a complete range of sizes, for any length stroke. Special cylinders built to order. Write for Bulletin 35-A.

HANNIFIN MANUFACTURING COMPANY
621-631 S. Kolmar Ave., Chicago 24, Illinois



METAL POWDERS

Prices are based on current market prices of ingots plus a fixed figure. For ton lots f.o.b. shipping point, in cents per lb.

Copper, electrolytic, 150 and 200 mesh	21⅛ to 23⅛c.
Copper, reduced, 150 and 200 mesh	20½ to 25½c.
Iron, commercial, 100 and 200 mesh	13½ to 15c.
Iron, crushed, 200 mesh and finer	40.
Iron, hydrogen reduced, 300 mesh and finer	63c.
Iron, electrolytic, unannealed, coarser than 300 mesh	30 to 33c.
Iron, electrolytic, annealed minus 100 mesh	42c.
Iron, carbonyl, 300 mesh and finer	90c.
Aluminum, 100 and 200 mesh.	*23 to 27c.
Antimony, 100 mesh	20.6c.
Cadmium, 100 mesh	$1
Chromium, 150 mesh	$1.03
Lead, 100, 200 & 300 mesh,	11½ to 12½c.
Manganese, 150 mesh	51c.
Nickel, 150 mesh	51½c.
Solder powder, 100 mesh,	8½c. plus metal
Tin, 100 mesh	58¾c

*Freight allowed east of Mississippi.

BOILER TUBES

Seamless Steel and Lap Weld Commercial Boiler Tubes and Locomotive Tubes, Minimum Wall. Net base prices per 100 ft. f.o.b. Pittsburgh, in carload lots.

		Seamless Cold Drawn	Hot Rolled	Lap Weld, Hot Rolled
2	in. o.d. 13 B.W.G.	15.03	13.04	12.33
2½	in. o.d. 12 B.W.G.	20.21	17.54	16.58
3	in. o.d. 12 B.W.G.	22.48	19.50	18.35
3½	in. o.d. 11 B.W.G.	28.37	24.62	23.15
4	in. o.d. 10 B.W.G.	35.20	30.54	28.66

(Extras for less carload quantities)

40,000 lb. or ft., and over	Base
30,000 lb. or ft. to 39,999 lb. or ft.	5%
20,000 lb. or ft. to 29,999 lb. or ft.	10%
10,000 lb. or ft. to 19,999 lb. or ft.	20%
5,000 lb. or ft. to 9,999 lb. or ft.	30%
2,000 lb. or ft. to 4,999 lb. or ft.	45%
Under 2,000 lb. or ft.	65%

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (rerolling only). Prices delivered Detroit are $2.00 higher; f.o.b. Duluth, billets only, $2.00 higher; billets f.o.b. Pacific ports are $12 higher. Delivered prices do not reflect new three per cent tax on freight rates.

	Per Gross Ton
Rerolling	$34.00
Forging quality	40.00
Alloy steel: Pittsburgh, Chicago, Canton, Massillon, Buffalo, or Bethlehem, per gross ton	$54.00

Shell Steel

	Per Gross Ton
3 in. to 12 in.	$52.00
12 in. to 18 in.	54.00
18 in. and over	56.00

Basic open hearth shell steel, f.o.b. Pittsburgh, **Chicago, Buffalo**, Gary, Cleveland, Youngstown and Birmingham.

Prices delivered Detroit are $2.00 higher.

Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting, or quantity.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open hearth or bessemer	$34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(No. 5 to 9/32 in.)

	Per Lb.
Pittsburgh, Chicago, Cleveland	2.00c.
Worcester, Mass.	2.10c.
Birmingham	2.00c.
San Francisco	2.50c.
Galveston	2.25c.

9/32 in. to 47/64 in., 0.15c. a lb. higher. Quantity extras apply.

TOOL STEEL

(F.o.b. Pittsburgh, Bethlehem, Syracuse)

	Base per lb.
High speed	67c.
Straight molybdenum	54c.
Tungsten-molybdenum	57½c.
High-carbon-chromium	43c.
Oil hardening	24c.
Special carbon	22c.
Extra carbon	18c.
Regular carbon	14c.

Warehouse prices east of Mississippi are 2c. a lb. higher; west of Mississippi 1c. higher.

CORROSION AND HEAT-RESISTING STEEL

(Per lb. base price, f.o.b. Pittsburgh)

Chromium-Nickel Alloys

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium Alloys

	No. 410	No. 430	No. 442	No. 446
F.Billets	15.725c.	16.15c.	19.125c.	23.375c.
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
Hot strip	17.00c.	17.50c.	24.00c.	35.00c.
Cold strip	22.00c.	22.50c.	32.00c.	52.00c.

Chromium-Nickel Clad Steel (20%)

	No. 304
Plates	18.00c.*
Sheets	19.00c.

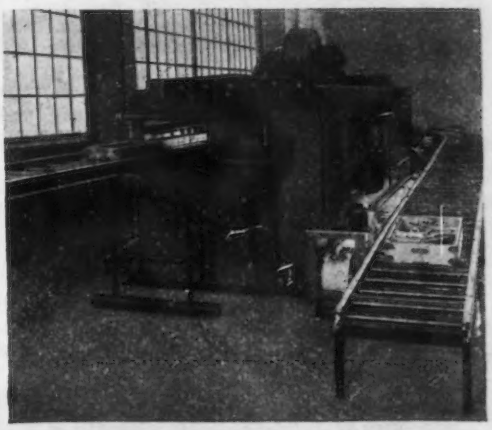
*Includes annealing and pickling.

RANSOHOFF LABOR-SAVING EQUIPMENT FOR THE SURFACE TREATMENT OF METALS

ONE MAN
operates this washing machine.

ONLY ONE SET OF PUMPS AND BLOWER
handles the cleaning compound, rinse water and drying air for both sections of the machine.

USED by large maker of fire arms. Sub-assemblies and delicate parts pass through the conveyor section in racks and return to the charging end on a roller conveyor. Small work, screw machine parts and similar work pass through the drum section and return to the charging end on a canvas belt conveyor.



Write the RANSOHOFF ENGINEERS

N. RANSOHOFF, Inc. 1315 Township Ave. CINCINNATI, O.

"HERCULES" REG. U.S. PAT. OFF. RED-STRAND WIRE ROPE

You Can Depend On "Hercules" (Red Strand) Wire Rope

Highlights of Quality

1. Acid Open-Hearth Steel Wire
2. Rigid Tests and Inspections
3. Correct Manufacturing Methods
4. Furnished in both the Round and Flattened Strand constructions, in either Standard or Preformed Type.

• • Results are what count, and the performance record of this wire rope continues to make and hold friends.

There is no guess work when you use "HERCULES" (Red-Strand) Wire Rope. It is designed and built to do specific jobs better . . . safer . . . more economically. If you will tell us how you use wire rope, we shall be glad to suggest the construction and type most suitable for your conditions.

MADE ONLY BY
A. LESCHEN & SONS ROPE CO.
WIRE ROPE MAKERS — ESTABLISHED 1857
5909 KENNERLY AVENUE — ST. LOUIS, MISSOURI, U. S. A.

NEW YORK • • • 90 West Street
CHICAGO • • 810 W. Washington Blvd.
DENVER • • • 1554 Wazee Street
SAN FRANCISCO • • 520 Fourth Street
PORTLAND • • 914 N. W. 14th Avenue
SEATTLE • • 3410 First Avenue South

CONCO 3-Motor Single Girder CAB OR FLOOR OPERATED ELECTRIC CRANE . . .

● **Available in capacities of one through five tons for floor or cab operation. Simply, ruggedly designed for low first cost and maintenance. Used with Low Headroom Type Hoist, provides for maximum space coverage horizontally and vertically. Effective in even a minimum space. Write for Bulletin 2000.**

Write for Bulletin 26000 describing the Torpedo Hoist shown. Three capacities 250 lb.—$139.50, 500 lb.—$149.50, 1000 lb.—$159.50. Heavily, simply built, with Push Button Control. Outstanding in CONCO'S complete line of hand-powered and electric Cranes, Hoists, Trolleys.

CONCO ENGINEERING WORKS

H. D. Conkey & Co. — 15 Grove St. — Mendota, Ill.

Builders Of Conco Torpedo Electric Hoist

MARVEL SAWS

A Complete System of Metal Sawing

The Marvel System of Metal Sawing provides the most complete line of sawing machines built including: the most widely used small shop saws (80% are MARVELS); the fastest high speed hack saws built (automatics that will cut-off identical bars with no more operator attention than an automatic screw machine); the most versatile metal cutting saw—(a universal metal cutting band saw). Giant Hydraulic hack saw that handles the largest and toughest bars and billets with ease; and the positively unbreakable MARVEL High-Speed-Edge Hack Saw Blades that permit any sawing machine to operate safely and continuously at full capacity.

MARVEL No. 18
Giant Hydraulic
Capacity 18"x18"

ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"
5700 Bloomingdale Ave. Chicago, U. S. A.

Eastern Sales Office
225 Lafayette St.
New York

PRICES

Ferromanganese

78-82% manganese, maximum contract base price per gross ton, lump size, f.o.b. car at Baltimore, Philadelphia, New York, Birmingham, Rockdale, Rockwood, Tenn.

Carload lots (bulk)	$135.00
Ton lots (packed)	141.00
Less ton lots (packed)	148.50

Premium, $1.70 for each 1% above 82% Mn; penalty, $1.70 for each 1% below 78%.

Electrolytic Manganese

99.9% manganese, maximum base contract price per lb. of metal, bulk, f.o.b. shipping point, with freight allowed to destination. Size, 1" x D.

	Eastern Zone	Central Zone	Western Zone
Carload lots	37.60c.	37.85c.	38.15c.
l.c.l. lots	39.60c.	38.60c.	40.65c.

Spiegeleisen

Maximum base contract prices, per gross ton, lump, f.o.b. Palmerton, Pa.

	16-19% Mn 1% max. Si	19-21% Mn 1% max. Si	26-28% Mn 1% max. Si
Carloads	$35.00	$36.00	$49.50
Less ton*	47.50	48.50	62.00

Electric Ferrosilicon

OPA maximum base price cents per lb. contained Si, lump size in carlots, f.o.b. shipping point with freight allowed to destination.

	Eastern Zone	Central Zone	Western Zone
50% silicon	6.65c.	7.10c.	7.25c.
75% silicon	8.05c.	8.20c.	8.75c.

Spot sales 45c. per lb. higher for 50% Si; 30c. for 75% Si. For extras and premiums see MPR 405.

Silvery Iron

(Per Gross Ton, base 6.00 to 6.50 Si)

F.o.b. Jackson, Ohio	$29.50*
Buffalo	30.75*

For each additional 0.50% silicon add $1 a ton. For each 0.50% manganese over 1% add 50c. a ton. Add $1 a ton for 0.75% phosphorus or over.

*Official OPA price established June 24, 1941.

Bessemer Ferrosilicon

Prices are $1 a ton above silvery iron quotations of comparable analysis.

Silicon Metal

OPA maximum base price per lb. of contained Si, lump size, f.o.b. shipping point with freight allowed to destination, for l.c.l. above 2000 lb., packed.

	Eastern Zone	Central Zone	Western Zone
96% Si, 2% Fe.	13.10c.	13.55c.	16.50c.
97% Si, 1% Fe.	13.45c.	13.90c.	16.80c.

Ferrosilicon Briquets

OPA maximum base price per lb. of briquet, bulk, f.o.b. shipping point with freight allowed to destination. Approximately 40% silicon.

	Eastern Zone	Central Zone	Western Zone
Car lots	3.35c.	3.50c.	3.65c.

Spot prices ¼c. higher per lb. of briquet. For premiums and extras see MPR 405.

Silicomanganese

(Per gross ton, delivered, carloads, bulk)

3.00 carbon	$120.00*
2.50 carbon	125.00*
2.00 carbon	130.00*
1.00 carbon	140.00*
Briquets, contract, basis carlots, bulk freight allowed, per lb.	5.80c.†
Packed	6.05c.†
Less ton lots	6.55c.†

*Spot prices are $5 per ton higher.
†Spot prices ¼c. higher.

Ferrochrome

(65-72% Cr, 2% max. Si)

OPA maximum base contract prices per lb. of contained Cr, lump size in carlots, f.o.b. shipping point, freight allowed to destination.

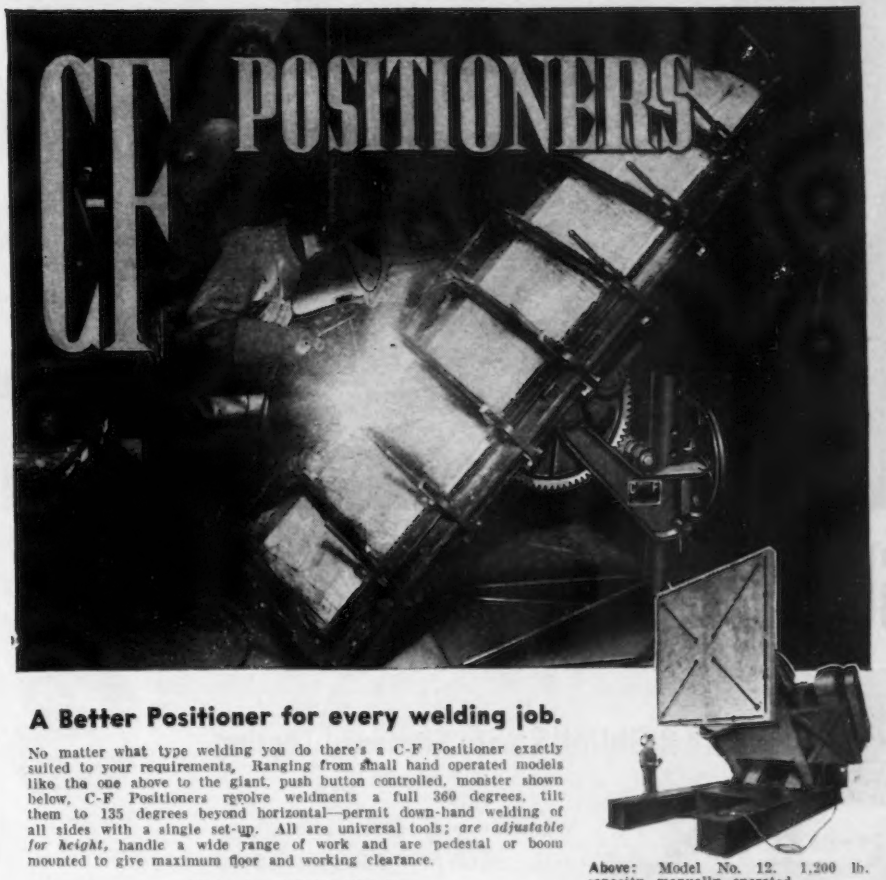
	Eastern Zone	Central Zone	Western Zone
0.03% carbon	25.00c.	25.40c.	26.00c.
0.06% carbon	23.00c.	23.40c.	24.00c.
0.10% carbon	22.50c.	22.90c.	23.50c.
1.00% carbon	20.50c.	20.90c.	21.50c.
2.00% carbon	19.50c.	19.90c.	20.50c.

Spot prices are ¼c. higher per lb. contained Cr. For extras and premiums see MPR 407.

PRICES

Other Ferroalloys

Ferrotungsten, delivered, carlots, per lb. contained tungsten	$1.90
Tungsten metal powder, 98%-99%, any quantity, per lb.	$2.60
Ferrovanadium, 35%-40%, contract basis, f.o.b. producers plant, usual freight allowances, open-hearth grade, per lb. contained vanadium	$2.70
Special grade	$2.80
Very special grade	$2.90
Vanadium pentoxide, 88%-92% V_2O_5 technical grade, contract basis, any quantity, per lb. contained V_2O_5	$1.10
Ferroboron, contract basis, 17.50% boron minimum, f.o.b. Niagara Falls, carlots, per lb. alloy	$1.20
Ton lots	$1.25
Silcaz No. 3, contract basis, f.o.b. Niagara Falls, all quantities, per lb. of alloy	23c.
Silvaz No. 3, contract basis, f.o.b. Niagara Falls, all quantities, per lb. of alloy	40c.
Grainal, f.o.b. Bridgeville, Pa., freight allowed 100 lb. and over, maximum based on rate to St. Louis, per lb.	45c.
Bortam, f.o.b. Niagara Falls	
Ton lots, per lb.	45c.
Less ton lots, per lb.	50c.
Borosil, 3% to 4% boron, 40 to 45% silicon, f.o.b. Philo, Ohio, per lb. contained boron	$7.00
Ferrocolumbium, 50% to 60%, f.o.b. Niagara Falls, ton lots, per lb. contained columbium	$2.25
Less ton lots	$2.30
Ferrotitanium, 40%-45%, f.o.b. Niagara Falls, N. Y., ton lots, per lb. contained titanium	$1.23
Less ton lots	$1.25
Ferrotitanium, 20%-25%, 0.10 C max., ton lots, per lb. contained titanium	$1.35
Less ton lots	$1.40
High-carbon ferrotitanium, 15%-20%, 6%-8% carbon, contract basis, f.o.b. Niagara Falls, N. Y., freight allowed East of Mississippi River, North of Baltimore and St. Louis, per gross ton	$142.50
3%-5% carbon	$157.50
Ferrophosphorus, 18% electric or blast furnace, f.o.b. Anniston, Ala., carlots, with $3 unitage freight equaled with Rockdale, Tenn., per gross ton	$58.50
Ferrophosphorus, electrolytic 23-26%, carlots, f.o.b. Monsanto (Siglo), Tenn., $3 unitage freight equalized with Nashville, per gross ton	$75.00
Ferromolybdenum, 55-75 per cent, f.o.b. Langeloth and Washington, Pa., any quantity, per lb. contained molybdenum	95c.
Calcium molybdate, 40%-45%, contract basis, f.o.b. Langeloth and Washington, Pa., any quantity, per lb. contained molybdenum	80c.
Molybdenum oxide briquettes, 48%-52% Mo, f.o.b. Langeloth, Pa., per lb. contained Mo	80c.
Molybdenum oxide, in cans, f.o.b. Langeloth and Washington, Pa., per lb. contained Mo	80c.
Molybdenum powder, 99%, in 200-lb. kegs, f.o.b. York, Pa., per lb.	$2.60
Under 100 lb.	$3.00
Zirconium, 35-40%, contract basis, carloads in bulk or package, per lb. of alloy	15c.
Less ton lots	16c.
Zirconium, 12-15%, contract basis, carlots, bulk, per gross ton	$102.50
Packed	$107.50
Less ton lots	$112.50
Alsifer (approx. 20% Al, 40% Si and 40% Fe), contract basis, f.o.b. Niagara Falls, per lb.	7.50c.
Ton lots	8c.
Simanal (approx. 20% Si, 20% Mn, 20% Al), contract basis, f.o.b. Philo, Ohio, with freight not to exceed St. Louis rate allowed, per lb.	
Car lots	9.50c.
Ton lots	10.00c.
Less ton lots	10.50c.



A Better Positioner for every welding job.

No matter what type welding you do there's a C-F Positioner exactly suited to your requirements. Ranging from small hand operated models like the one above to the giant, push button controlled, monster shown below, C-F Positioners revolve weldments a full 360 degrees, tilt them to 135 degrees beyond horizontal—permit down-hand welding of all sides with a single set-up. All are universal tools; *are adjustable for height*, handle a wide range of work and are pedestal or boom mounted to give maximum floor and working clearance.

Write for Bulletin WP 22.

CULLEN-FRIESTEDT CO. 1303 S. Kilbourn Ave. Chicago 23, U.S.A.

Above: Model No. 12. 1,200 lb. capacity manually operated.
Below: Model No. 300. 30,000 lb. capacity, push button control with variable speed rotation for automatic welding.

How many FEATHERS in a Hen?

Our department of weights and standards, after plucking several specimens, has placed the problem back in our laps with no answer.

Many spring users have placed spring problems hard to solve in our hands to analyse and standardize. Scientific control of materials, close supervision of manufacture, automatic heat-treating, and accurate inspection and testing will give your springs a uniform degree of performance that eliminates kick-backs.

Buy springs that give known performance!

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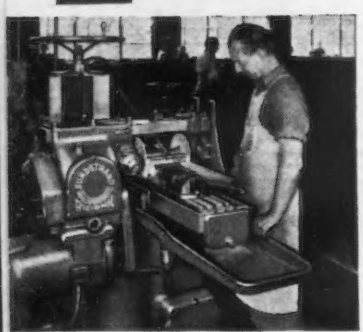
HOW TO GET THE *most economical solution* to your milling production requirements

SUNDSTRAND ENGINEERS can solve it whether it requires...

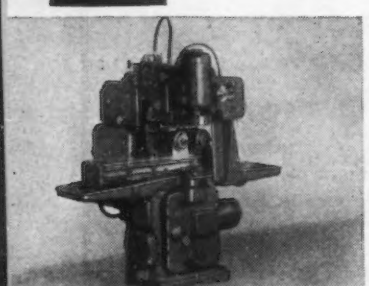
1 Standard RIGIDMILS with Standard Tooling



Standard Rigidmil with Standard Tooling

Whenever possible, milling production problems are solved most economically by standard Sundstrand Rigidmils using standard attachments such as vises, indexing bases, vertical heads and any other standard equipment which can solve the problem economically. Next most economical solution is...

2 Standard RIGIDMILS with Special Heads and Tooling



ndard Rigidmil with Special Tooling

Standard Sundstrand Rigidmils are designed to accommodate the application of a wide variety of special heads and tooling. Consequently, an unlimited number of milling production problems can be solved with special arrangements of standard Rigidmils. When not economical to do this, our Engineers can design...

3 Entirely Special Machines

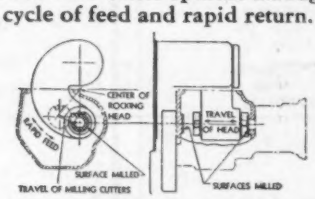
These machines are designed only when the required production cannot be obtained most economically by either of the foregoing methods.

Milling Internal Gear Bosses

The design of this transmission case is such that it placed a limitation on the size of the cutter head that could be used. The drawing below illustrates the method in which these out-of-the-way bosses were reached.

Operations—The operations consist of milling one of the bosses first, then shifting the cutter head and milling the other bosses.

The Machine consists briefly of a compact cast iron base having a rotating drum type spindle carrier. The drum is powered for rotation to rock the cutter spindle through a cycle of feed and rapid return.



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